OKIDATA®

Service Manual

ML590 // ML591
Dot Matrix Printers

Adobe Acrobat printable reference
copy of the OKIDATA Service Training Manual.
09/17/97

Note: This Adobe Acrobat version of the Okidata Service Training Manual was built with the pictures rendered at 300 dpi, which is ideal for printing, but does not view on most displays well.

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Chapter 0 About This Manual

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OKIDATA®

Service Guide ML590/ML591

Chapter 0 About This Manual

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1.1.01 General Information

The Microline 590 and Microline 591 are letter quality dot-matrix printers which utilize OKISMART paper handling. Patented Okidata technology does away with the manual head gap adjustment. The Microline 590/591 actually "reads and learns" the media you feed in, then automatically adjusts the head gap to the optimum distance. This auto-gapping process leads to longer printhead life.

An optional, user-installable Color Kit (coupled with a customer-provided color software package) allows the printers to add impact to graphics, charts, transparencies and text presentations.

Additional options include the Bottom Feed Push Tractor, Cut-Sheet Feeder, Pull Tractor and Serial Interface Board.

The Microline 590 is an 80 column printer.

The Microline 591 is a 132 column printer.

Okidata's extended two year limited warranty covers the parts, labor and printhead on both printers.

The following items are included with the printer:

OKISMART Typer - software which provides the flexibility for the Microline 590/591 to function like a typewriter on checks, labels and envelopes.

OKISMART Panel - a utility program that lets you control selected printer functions from your personal computer.

Scalable Fonts - 14 scalable fonts, available on diskette.

Note: The OkiSmart software includes three programs:

1. OkiSmart Control
2. OkiSmart Panel Emulator
3. OkiSmart Setup

Refer to the Printer Handbook for more information.

1.2 PHYSICAL SPECIFICATIONS

1.2.01 Dimensions

Note: Dimensions INCLUDE the platen knob, acoustic cover, and paper separator.

Microline 590
Width: 18.35 inches (466 millimeters)
Depth: 17.24 inches (438 millimeters)
Height: 6.52 inches (165 millimeters)

Microline 591
Width: 24.41 inches (620 millimeters)
Depth: 17.24 inches (438 millimeters)
Height: 6.52 inches (165 millimeters)

1.2.02 Printer Weight

Microline 590
16.5 pounds (6.5 kilograms)

Microline 591
19.8 pounds (8.9 kilograms)

1.3 POWER REQUIREMENTS

1.3.01 Input Power

120 VAC: +5.5 / -15%
230/240 VAC: +10 / -14%

1.3.02 Power Consumption

Operating: 110 VA
Idle: 40 VA

1.3.03 Power Frequency

120 VAC: 60 Hz +/- 2%
230/240 VAC: 50/60 Hz +/- 2%

1.4 ENVIRONMENTAL CONDITIONS

1.4.01 Acoustic Rating
Letter Quality Mode: 53 dBA
Quiet Mode: 50 dBA

1.4.01 Altitude
10,000 feet (3,050 meters)

1.4.03 Ambient Temperature and Relative Humidity (RH)
While operating: 41° to 104° F (5° to 40° C)
Operating humidity: 20% to 80% RH
While in storage: 14° to 122° F (-10° to 50° C)
Storage humidity: 5% to 95% RH

1.5 AGENCY APPROVALS

1.5.01 Listings

UL No:	UL Standard No. 1950
CSA No:	CSA Standard 22.2-950
FCC:	FCC Certified per Part 15, Subject J, Class B
IEC:	IEC 950
VDE:	VDE 0805 VDE 0875 Class B
BS:	BS 7002

1.6.01 Character Matrix Sizes

Table of Print Speed and Character Matrix

Mode	LQ	Utility	High Speed Draft
Speed	120 (12 cpi)	360 (12 cpi)	450 (15 cpi)
Matrix (H x V)	29 x 18	9 x 17	7 x 17

Print Speed at Different CPI for the ML 590

Mode	CPI	CPS	Horiz. DPI	Vert DPI	IPS
Utility	10	300	120	180	30
	12	360	120	180	30
	15	450	120	180	30
	17.1	257	240	180	15
	20	300	240	180	15
LQ	10	100	360	180	10
	12	120	360	180	10
	15	150	360	180	10
	17.1	171	360	180	10
	20	200	360	180	10

1.6.02 Characters Per Line

Microline 590

Characters Per Line	Characters Per Inch	Utility	Letter Quality
80	10	164	65
96	12	161	65
120	15	148	65
136	17.1	96	65
160	20	95	65

Microline 591

Characters Per Line	Characters Per Inch	Utility	Letter Quality
136	10	105	40
163	12	96	40
204	15	88	40
233	17.1	59	40
272	20	59	40

1.6.03 Character Pitches

5, 6, 8.5, 10, 12, 15, 17.1, 20

1.6.04 Character Sets

Standard ASCII
EPSON Character Set I & II
IBM Character Set I, II & All Characters
Foreign Character Substitution
International Character Sets
Code Page 850, 860, 863 and 865
Bar Code:
- Code 39
- UPC A
- UPC E
- EAN 8
- EAN 13
- Interleaved 2 of 5
- Code 128
- POSTNET

1.6.05 Printer Emulations

Note: The emulations are co-resident

Epson LQ
IBM XL 24E (AGM)
IBM Proprinter

1.6.06 Fonts

Letter Quality

Courier
Letter Gothic
Prestige
Orator
Roman
Swiss

Draft

Utility
High Speed Draft (15 cpi)

Bar Code

Code 39
UPC A
UPC E
EAN 8
EAN 13
Interleaved 2 of 5
Code 128
POSTNET

1.6.07 Front Panel Switches

Select	Micro Feed Up / Down
Menu Mode	Paper Park
Line Feed	Pitch Selection
Form Feed	Print Quality Selection
Top of Form	Tear
Quiet	

1.6.08 Graphics Resolution

Graphics Resolution: 360 x 360 DPI maximum

1.6.09 Interface

Standard
Parallel

Optional
RS232C Serial

1.6.10 Line Feed Increments

Fixed

(6 lines per inch lpi) [0.167 inch (4.23 millimeters)]
(8 lines per inch lpi) [0.125 inch (3.175 millimeters)]

Variable

n/60 inch
n/72 inch
n/180 inch
n/216 inch
n/360 inch

1.6.11 Line Feed Time

65 milliseconds	6 lines per inch (lpi)
6 milliseconds	8 lines per inch (lpi)
1 second	5.0 inches (Continuous paper feed rate)

1.6.12 Menu Mode

Print: Prints the entire menu.
Group: Selects Group Function
Item: Selects Item
Set: Selects Item Value
Exit: Exits Menu Mode, Enters Select

1.6.13 Paper Feed Methods

Standard

Friction Feed (Top)
Rear Push Tractor (Rear)

Optional

Pull Tractor (Bottom)
Bottom Push Tractor (Bottom)
Single-Bin Cut Sheet Feeder (Top)
- CSF 5000 - Narrow
- CSF 5001 - Wide

1.6.14 Paper Feed Paths

Top Feed (Standard)
Rear Feed (Standard)
Bottom Feed (by using an Optional feed mechanism)
Special Features
- Paper Park
- Automatic Paper Loading
- Forms Tear Off

1.6.15 Paper Loading

Auto Loading (Top Feed)
Press **LOAD** switch for Bottom/Rear Feed

1.6.16 Paper Out Detection

Distance from end of paper

Rear Feed:	0.5 inches (12.7 mm)
Bottom Feed:	0.5 inches (12.7 mm)
Top Feed:	0.5 inches (12.7 mm)

1.6.17 Paper Tear Capabilities

Forms Tear-0ff (sharp edge on access cover)
Metal Tear Bar (with optional bottom tractor unit)

1.6.18 Print Method

Printhead Type

General Information

Impact: Dot Matrix
24 pin printhead
.0079 inch (.20 millimeter) diameter pins

Overheat Protection

When printhead temperature exceeds 110 degrees Celsius, the printer stops bi-directional printing. Uni-directional printing begins.
If the temperature exceeds 115 degrees Celsius, printing stops.
Printing will resume when the printhead temperature drops below 115 degrees Celsius.

Note: Refer to Section Two for more information on printhead operation.

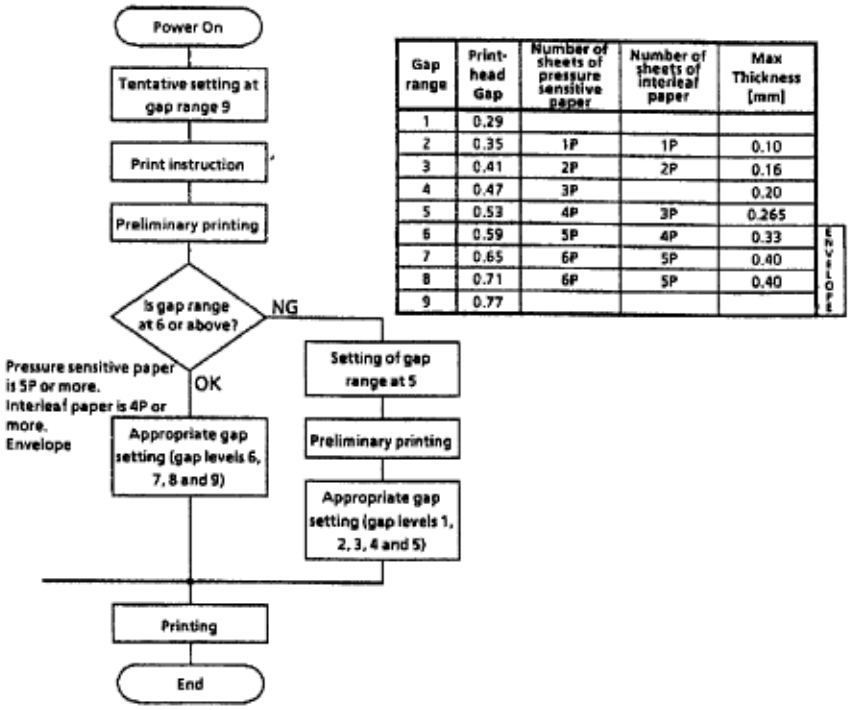
Printhead Gap Information

Three items factor into printhead gap information.

1. Printhead Gap Adjustment
   This is a **SERVICE ADJUSTMENT** made by a technician.
   It is covered in Section 3.3 of this Service Handbook.
   The Adjustment measures 0.014, +/- 0.001 inches (0.35, +/- 0.03 mm).

2. Printhead Gap Adjust
   This is a **MENU ITEM** in the **SET-UP** Group.
   It fine tunes the automatic setting of the printhead gap.
   The settings are 0, 1, and -1.
   0 is the factory default.
   Use 1 to darken print (if output is consistently light).
   Use - 1 to lighten print (if output is consistently dark).

3. Gap Control
   This is a **MENU ITEM** in each [Paper Feed] Group.
   The Groups are **REAR FEED, BOTTOM FEED,** and **TOP FEED**.
   Gap Control determines how the printhead gap is set.
   The settings are listed below.
   Auto Gap, Semi Auto Gap, 1, 2, 3, 4, 5, 6, 7, 8, 9
   An explanation of each setting follows.
   Auto Gap
   This is the factory default.
   Automatically determines paper thickness of the first page.
   During single-sheet feed, each page's thickness is checked while a job is printing.
   Semi Auto Gap
   Similar to Auto Gap.
   Automatically determines paper thickness of the first page.
   During single-sheet feed, each page's thickness IS NOT checked "while" a job is printing
   1, 2, 3, 4, 5, 6, 7, 8, 9
   Used when the same paper is used ALL of the time.
   Bypasses the automatic head gap adjustment.
   1 is the narrowest gap setting.
   9 is the widest gap setting.



Gap range	Print-head Gap	Number of sheets of pressure sensitive paper	Number of sheets of interleaf paper	Max Thickness [mm]
1	0.29			
2	0.35	1P	1P	0.10
3	0.41	2P	2P	0.16
4	0.47	3P		0.20
5	0.53	4P	3P	0.265
6	0.59	5P	4P	0.33
7	0.65	6P	5P	0.40
8	0.71	6P	5P	0.40
9	0.77			

ENVELOPE

1.6.19 Print Modes

Letter Quality
Utility
High Speed Draft

1.6.20 Print Speed

Table of Print Speed and Character Matrix

Mode	LQ	Utility	High Speed Draft
Speed	120 (12 cpi)	360 (12 cpi)	450 (15 cpi)
Matrix (H x V)	29 x 18	9 x 17	7 x 17

1.7 PAPER SPECIFICATIONS

CAUTION: Use Bottom Feed and/or optional Pull Tractor for card stock and labels.

1.7.01 Types

Card Stock

Weight:	120 lbs. (450 g/m2)	Maximum
Width:	Microline 590	5 to 8 inches (12.7 to 20.3 centimeters)
	Microline 591	5 to 14 inches (12.7 to 35.6 centimeters)
Length:	3 to 17 inches (7.62 to 43.18 centimeters)	
Thickness:	.017 inches (0.44 millimeters)	
Paper Feed Path:	Bottom	
Printhead Gap Information:	Refer to the Printhead Gap Information, Section 1.6.	

Continuous Form

Weight:		
Single Part	12 - 24 lb. (45 to 90 g/m2)	
Multi-Part Carbonless	9 - 11 lb. (35 to 40 g/m2)	
Multi-Part, Interleaf Paper	10 - 12 lb. (38 to 45 g/m2) Carbon	9 lb. (35 g/m2)
Width:	Microline 590	3.5 to 10.5 inches (8.8 to 26.6 centimeters)
	Microline 591	3.5 to 16.5 inches (8.8 to 41.9 centimeters)
Length:	3 to 17 inches (7.62 to 43.18 centimeters)	
Thickness:	0.014 inches (0.36 millimeters) Rear Feed 0.017 inches (0.44 millimeters) Bottom Feed	
Paper Feed Path:	Rear or Bottom	
Printhead Gap Information:	Refer to the Printhead Gap Information, Section 1.6	

Cut Sheet

Weight:	12 to 24 lbs. (45 to 90 g/m2)	
Width:	7.2 to 14.3 inches (18.3 to 36.3 centimeters)	
Width:	Microline 590	7.2 to 8.5 inches (18.2 to 21.5 centimeters)
	Microline 591	7.2 to 14.3 inches (18.2 to 36.3 centimeters)
Length:	3 to 17 inches (7.62 to 43.18 centimeters)	
Thickness:	0.014 inches (0.325 millimeters) Maximum	
Paper Feed Path:	Top	
Printhead Gap Information:	Refer to the Printhead Gap Information, Section 1.6.	

Envelopes

Weight:	24 lbs. (90 g/m2)	Maximum
Size:		

Single Feed
Minimum: 6.5 x 3.6 inches (16.5 x 9.1 centimeters)
Maximum: 9.5 x 4.1 inches (24.1 x 10.4 centimeters)
Continuous
Non-overlap type
Thickness: .014 inches (.325 millimeters) Maximum
Paper Feed Path: Bottom
Printhead Gap Information: **Refer to the Printhead Gap Information, Section 1.6.**

Labels

Weight: N/A
Width: Microline 590 3.5 to 10.5 inches (8.8 to 26.6 centimeters)
Microline 591 3.5 to 16.5 inches (8.8 to 41.9 centimeters)
Length: 3 to 17 inches (7.62 to 43.18 centimeters)
Thickness: .011 inches (0.28 mm) Maximum (including backing)
Paper Feed Path: Bottom
Printhead Gap Information: **Refer to the Printhead Gap Information, Section 1.6.**

CAUTION: Use Bottom Feed and/or optional Pull Tractor for card stock and labels.

Transparency

Note: Roller marks may mar the transparency under high temperature/ high humidity conditions.
Weight: 12 to 24 lbs. (45 to 90 g/m2)
Width: Microline 590 7.2 to 8.5 inches (18.2 to 21.5 centimeters)
Microline 591 7.2 to 14.3 inches (18.2 to 36.3 centimeters)
Length: 3 to 17 inches (7.62 to 43.18 centimeters)
Thickness: 0.14 inches (0.36 millimeters)
Paper Feed Path: Top
Printhead Gap Information: **Refer to the Printhead Gap Information, Section 1.6.**

1.7.02 Length

Note: The recommended length is specific to paper type.
Rear Feed
Minimum 3 inches (7.62 centimeters)
Maximum 17 inches (43.18 centimeters)
Bottom Feed
Minimum 3 inches (7.62 centimeters)
Maximum 17 inches (43.18 centimeters)
Top Feed
Minimum 3 inches (7.62 centimeters)
Maximum 17 inches (43.18 centimeters)

1.7.03 Number of Copies

Original + 4 Interleaf
Original + 4 Carbonless
Original Cut Sheet

1.7.04 Thickness

0.014 inches / 0.36 mm Maximum Thickness, Rear Feed
0.017 inches / 0.44 mm Maximum Thickness, Bottom Feed

1.7.05 Weight

Note: The recommended weight is specific to paper type.

Minimum: 9 lb. (35 g/m2)

Maximum: 24 lb. (90 g/m2)

1.7.06 Width

Note: The recommended width is specific to paper type.

Paper

Microline 590

Minimum: 3.5 inches (8.8 centimeters)

Maximum: 10.5 inches (26.6 centimeters)

Microline 591

Minimum: 3.5 inches (8.8 centimeters)

Maximum: 16.5 inches (41.9 centimeters)

Printing Area

Microline 590	8 inches	Maximum
Microline 591	13.6 inches	Maximum

1.8 MEMORY SPECIFICATIONS

1.8.01 EEPROM

1 Kbit serial EEPROM (used to store Menu data)

1.8.02 ROM

"Older" Configuration
1 Mbit, Character Generator ROM (located on main control board, 05C)
1 Mbit, Printer Control EPROM (located on main control board, 05D)
"New" Configuration
4 Mbit (located on main control board, 05D)

1.8.03 RAM

Receive Buffer Size is selected through the Menu.
Settings are: 64 K, 32 K, 1 line

1.9 CONSUMABLES

1.9.01 Ribbon

CAUTION: Using a non-Okidata ribbon may damage the printhead and void any warranties.

Material
- Cartridge Fabric

Types
- Black Ribbon
- Color Ribbon
  - Magenta
  - Yellow
  - Cyan
  - Black

Life (On average, at 10 characters per inch, Utility Mode)
- Black Ribbon 4 million characters
- Color Ribbon
  - Magenta 1.5 million characters
  - Yellow 0.8 million characters
  - Cyan 1.5 million characters
  - Black 1.5 million characters

1.10 OPTIONS

1.10.01 Cut Sheet Feeders

The CSF-5000 is a narrow feeder for the Microline 590.
- Single Bin with envelope capability
- Paper Width: 7.2" to 8.5" (18.3 cm to 36.3 cm)
- Paper Length: 10.1" to 14" (25.6 cm to 35.6 cm)
- Capacity: 170 sheets (16 lb.), 100 sheets (20 lb.)

The CSF-5001 is a wide feeder for the Microline 591.
- Single Bin with envelope capability
- Paper Width: 7.2" to 14.3" (18.3 cm to 36.3 cm)
- Paper Length: 10.1" to 14" (25.6 cm to 35.6 cm)
- Capacity: 170 sheets (16 lb.), 100 sheets (20 lb.)

1.10.02 Pull Tractor Kit

Note: The Pull Tractor Kit (P/N 70023001) is a narrow feeder for the Microline 590.
The Pull Tractor Kit (P/N 70023201) is a wide feeder for the Microline 591.

Bottom Feed
Rear Feed (For Push/Pull Operation)
Paper Types: Continuous Feed and Labels

1.10.03 Color Ribbon Kit

Includes:

Color mechanism
Color Ribbon

End user installable

1.10.04 Bottom Push Tractor Kit

Note: The Bottom Push Tractor Kit (P/N 70022901) is a narrow feeder for the Microline 590. The Bottom Push Tractor Kit (P/N 70023101) is a wide feeder for the Microline 591.

Bottom Feed
Paper Type: Continuous Feed
Includes: Stand and Metal Tear B

1.10.05 Serial Interface

Super-Speed 19.2K RS-232C
Ready/Busy/X-On/X-Off Protocols
Can be configured through the Menu or OKISmart Utility Program

1.10.06 Roll Paper Stand

Adapts printer for use with roll-type paper (Model 590 only)
Includes: Stand, Support, Cord and DIN plug for connection to printer

1.10.07 Bitstream Facelift 2.0

For Windows 3.0 and 3.1
Includes: 14 scalable fonts

1.10.08 OKISmart Typer Utility

Packaged with printer
Includes: Typewriter Mode, Form Creation Utility and Barcode Utility

1.10.09 OKISmart Panel Utility

Packaged with printer

Includes: Front Panel Control Utility and Drivers for Windows 3.0 & 3.1

Note: The OkiSmart software includes three programs.

1. OkiSmart Control
2. OkiSmart Panel Emulator
3. OkiSmart Setup

Refer to the Printer Handbook for more information.

1.11 RELIABILITY

1.11.01 Mean Time Before Failure (MTBF)
Approximately 6,000 hours: 25% duty cycle / 35% page density

1.11.02 Mean Time To Repair (MTTR)
Approximately 15 minutes to major sub-assembly level

1.11.03 Printer Life
Approximately 16,000 hours of power-on time: 25% duty cycle / 35% page density

1.11.04 Printhead Life
Average 200 million characters in 10 cpi utility mode @ normal 25% duty, 35% page density

1.11.05 Ribbon Life

Black:	Approximately 4 million characters
Color:	
Black:	Approximately 1.5 million characters
Cyan:	Approximately 1.5 million characters
Magenta:	Approximately 1.5 million characters
Yellow:	Approximately 0.8 million characters

1.11.06 Warranty (Limited)
Two years, parts and labor

1.11.07 Service
Authorized Okidata Service Centers

2.1 ELECTRICAL OPERATION

2.1.01 General Information

The printers is made of the following electrical components.

Main Control Board
Power Supply Assembly
Operator Panel
Space Motor / Line Feed Motor
Printhead

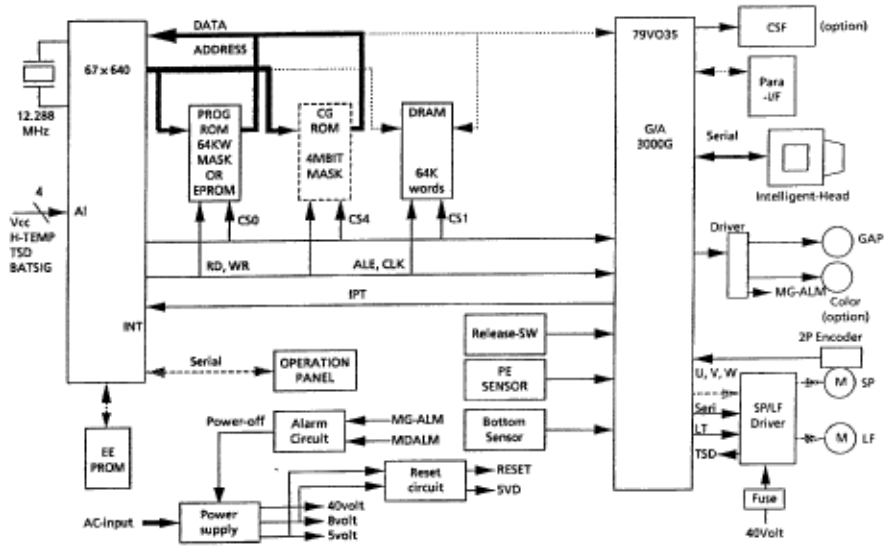
2.1.02 Main Control Board

The main control board is made up of the microprocessor, peripheral circuits, drive circuits, sensors and interface connectors.

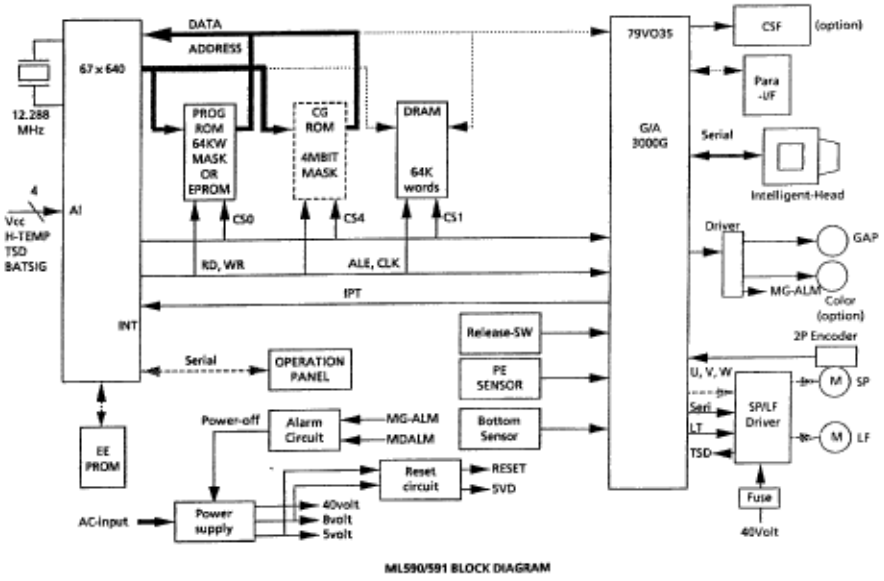
The power to the main control board is supplied by the power supply assembly through a wire harness. The power to other electrical parts, such as the line feed motor, space motor and printhead, is supplied by the power supply assembly through the connectors on the main control board.

Microprocessor (MPU)

Location 04D: 67X640
16 bit MPU, using CMOS technology.
The MPU contains a 20 bit address bus, a 16 bit data bus.
The MPU can access 1 Mbyte of program memory space and 1 Mbyte of data memory space.
The microprocessor controls the entire printer by executing the control program through the LSI and the driver circuit.



ML590/591 BLOCK DIAGRAM



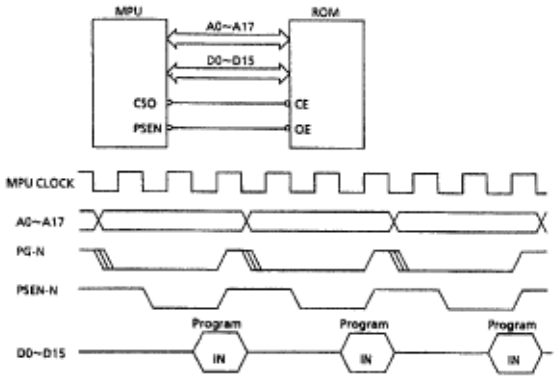
ML590/591 BLOCK DIAGRAM

Program ROM

Location 05D: 27C1024

This 64k x 16 bit (Mbit) EPROM contains the control program for the printer. The MPU executes the instructions contained in this program.

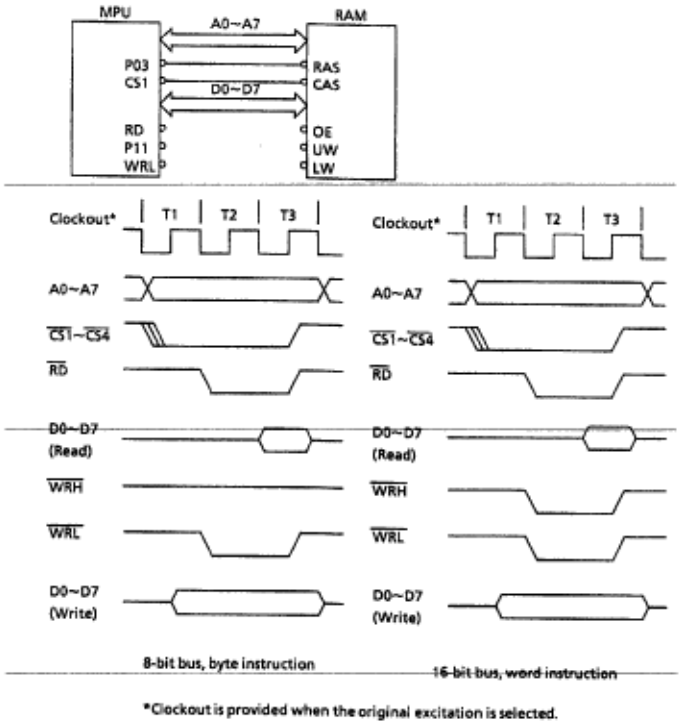
The Program ROM is assigned to the program memory area of the MPU and instructions are fetched by the PSEN signal of the MPU.



RAM

Location 05E: 511664Z.

The RAM is CMOS dynamic RAM with 65,536 words x 16-bit configuration, and is used as a receive buffer, print buffer and work buffer.

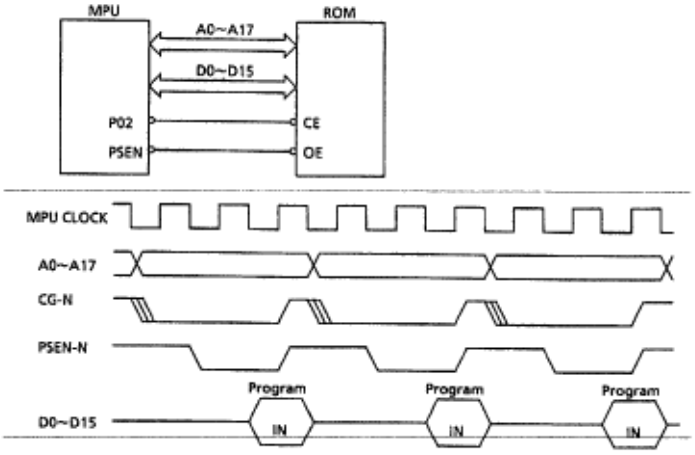


Character Generator ROM (CG ROM)

Location 05C: 27C4096.

This 256k x 16 bits (4 Mbit) masked EPROM contains the character data for the various fonts.

The CG ROM is assigned to the program memory area of the MPU. The data is accessed by the PSEN signal of the MPU.

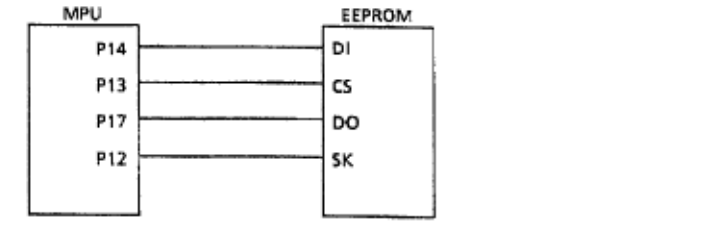


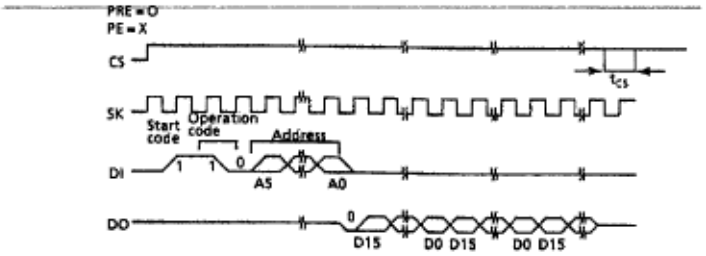
Electrically Erasable Programmable ROM (EEPROM)

Location 03C: 93CS46.

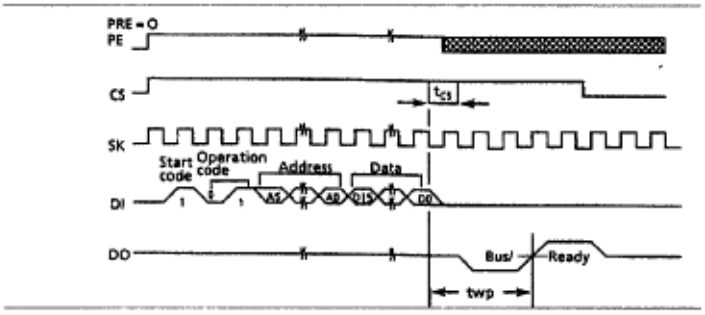
The EEPROM is a CMOS serial I/O type memory which is capable of electrically erasing and writing 1,024 bits

The EEPROM contains the menu data and the head drive time correction data.





Read cycle timing (READ)



Write cycle timing (WRITE)

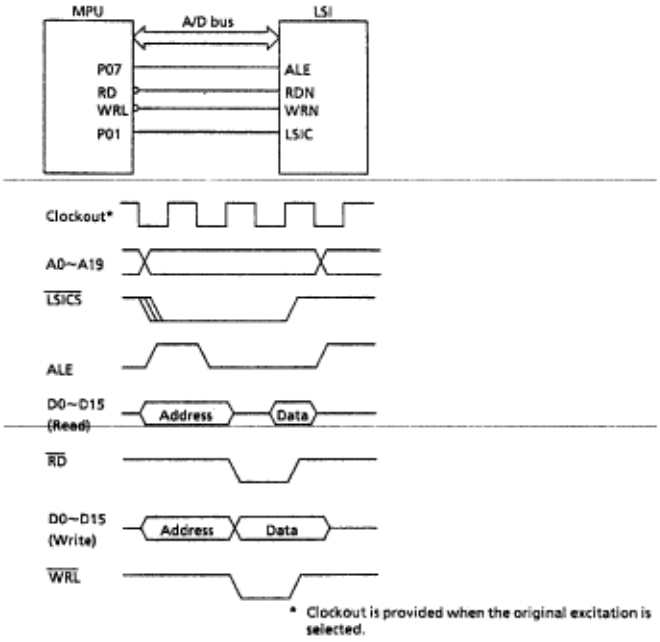
LSI

Location 02D: MSM(79V035).

Detects the output of the two-phase sensor on the DC space motor to control the motor drive phase.

Transmits and receives serial data to and from the printhead based on the dot timing (which is derived from the space motor speed).

Controls the external interface. The LSI is connected to the MPU.



2.1.03 Initialization

This printer is initialized when the printer is powered on or when the I-PRIME-N signal is input from the host via the parallel interface.

Printer Initialization occurs as listed below.

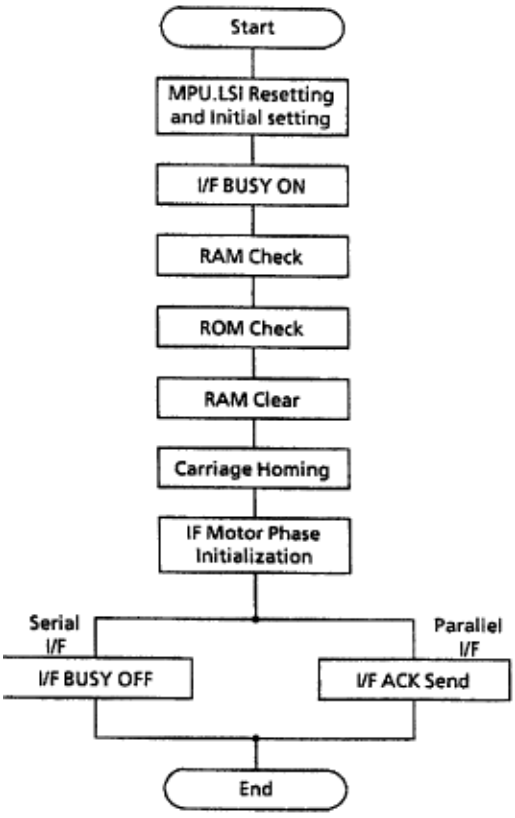
The RST-N signal is output from the Reset circuit to reset the MPU and LSIs.

The program is executed and the LSIs are reset by the MPU via IORST-N.

Note: A Reset operation initiated by I-PRIME does not reset the MPU.

The program sets the LSI (02D) mode, checks the memory (ROM/RAM), then executes carriage homing and determines the phase of the line feed motor.

Finally, the program establishes the interface signals (P-I/F: ACK-P signal sending, and S-I/F: BUSY-N signal off) and lights the SELECT lamp to indicate that the printer is in the ON-LINE state.

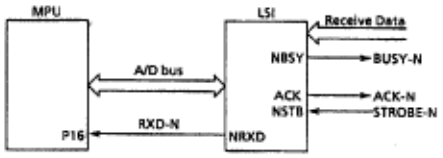


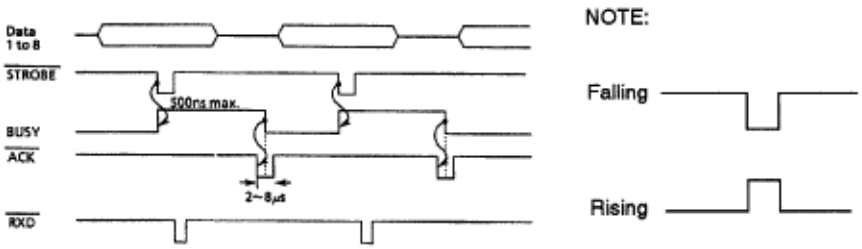
2.1.04 Parallel Interface Control

The parallel data input from the host to the interface LSI is latched to the internal register by the falling edge of the STROBE-N signal.

The LSI sets the BUSY-N signal to inform the host that the data is being processed. The LSI also outputs the RXD-N signal to inform the MPU of data reception. The data is read upon receiving the RD-N signal from the MPU.

When the data processing is complete, the BUSY-N signal is disabled and the ACK-N signal is sent to request the next data. When the buffer is full and reception is not desired, the BUSY signal is sent to request data transmission be stopped.

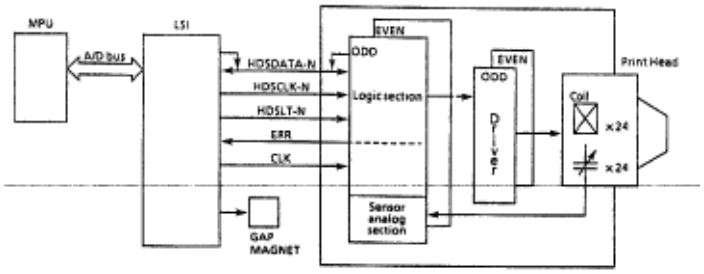




2.1.05 Print Control

The print data is transmitted as serial data from the LSI to the control circuit and the driver contained in the printhead.

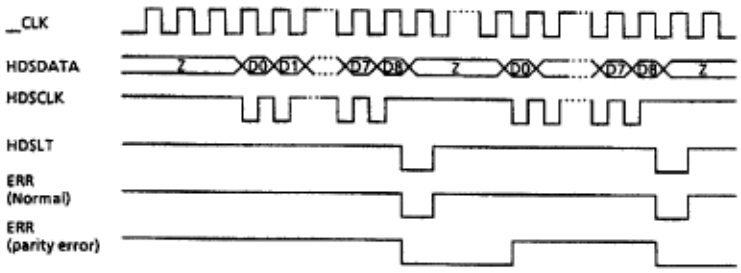
After the data is printed, the sensor analog circuit controlling each pin returns the pin stroke data to the MPU. The MPU will make an automatic head gap adjustment. This feedback system sets the optimum drive time for each pin in order to maintain high print quality.



LSI/Printhead Interface

The connection between the LSI and the printhead is made with the bi-directional serial data bus. The LSI transmits the print data as serial data to the logic circuit of the printhead. The printhead returns serial data from the printhead sensor analog circuit to the LSI. This information is used to determine the optimum drive time for the next print request.

The logic circuit of the printhead signals the LSI if a parity error is detected in the print data.

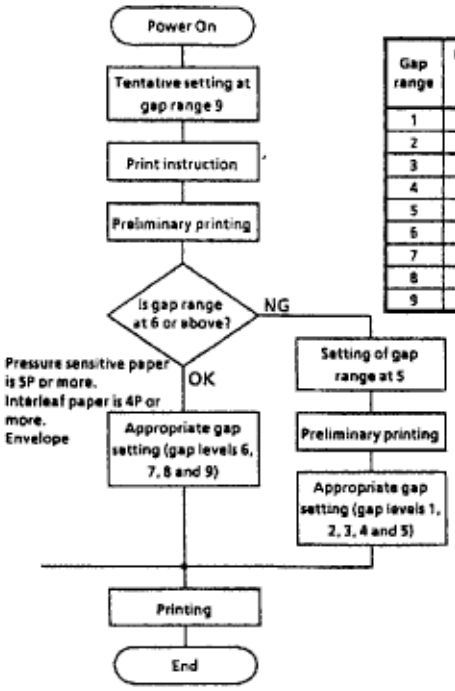


Gap Adjust Control

The Gap Adjust LSI receives stroke length information for all of the printhead pins from the sensor analog circuit. The Gap Adjust LSI then sets the optimum printhead gap for the printing medium.

Note: Refer to Section 2.2.03 for a description of the mechanical process.

All values in the chart are in millimeters

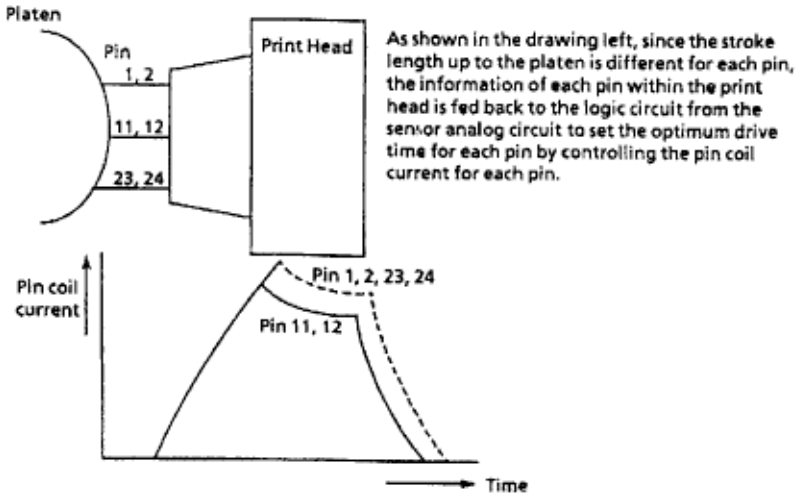


Gap range	Print-head Gap	Number of sheets of pressure sensitive paper	Number of sheets of interleaf paper	Max Thickness [mm]	
1	0.29				
2	0.35	1P	1P	0.10	
3	0.41	2P	2P	0.16	
4	0.47	3P		0.20	
5	0.53	4P	3P	0.265	
6	0.59	5P	4P	0.33	ENVELOPE
7	0.65	6P	5P	0.40	
8	0.71	6P	5P	0.40	
9	0.77				

Print Compensation Control

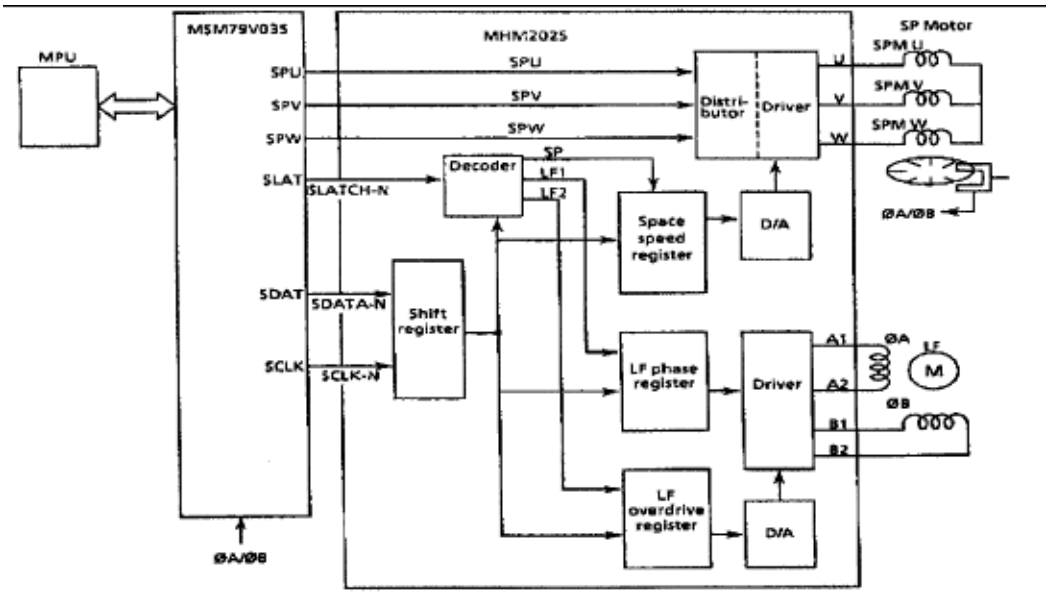
The printhead compensates for the shape of the platen as shown below.

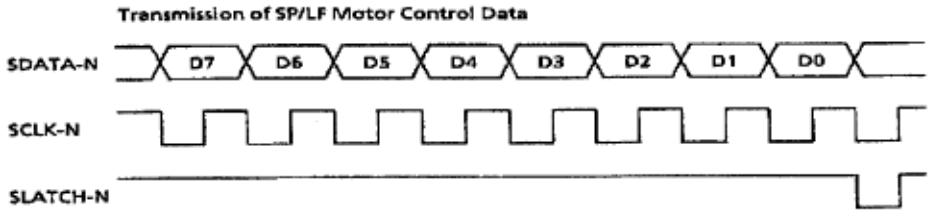
Note: Refer to Section 2.1.08 - Head Drive Time



2.1.06 Space and Line Feed (SP/LF) Motor Control

The LSI (Location 02D: MSM79V035) generates the space motor and the line feed motor control signals according to commands received from the MPU. These signals are sent to the SP/LF motor driver.

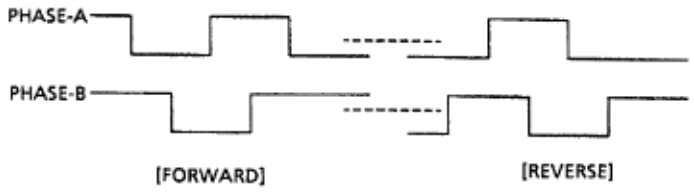




Line Feed Motor Control

The SP/LF motor driver (Location 5A: MHM2025) drives the line feed motor in two-phase bipolar, based on the phase changeover data output from the LSI.

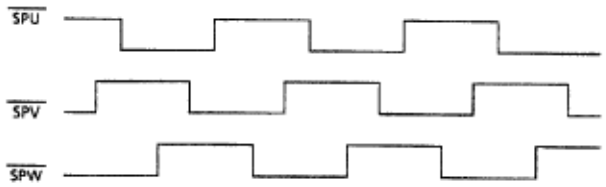
The serial data from the LSI (02D:MSM79V035) is processed by a register contained in the SP/LF motor driver to measure the overdrive time and to change the phase.



Space Motor Control

The SP/LF motor driver (Location 5A: MHM2025) drives the three-phase brushless motor. Motor movement is based on the phase signal (SPU,SPV and SPW) and the speed instruction data from the LSI. The MPU can identify the current speed of the space motor by measuring the pulse width of the output (Phase A, Phase B) of the encoder disk sensor.

After comparing the target speed for each print mode with the actual speed, the motor is accelerated or decelerated to maintain the desired speed for each print mode.



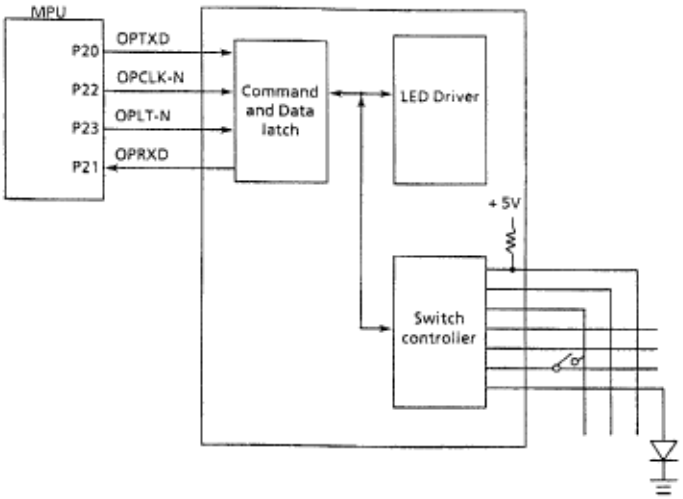
Encoder Disk

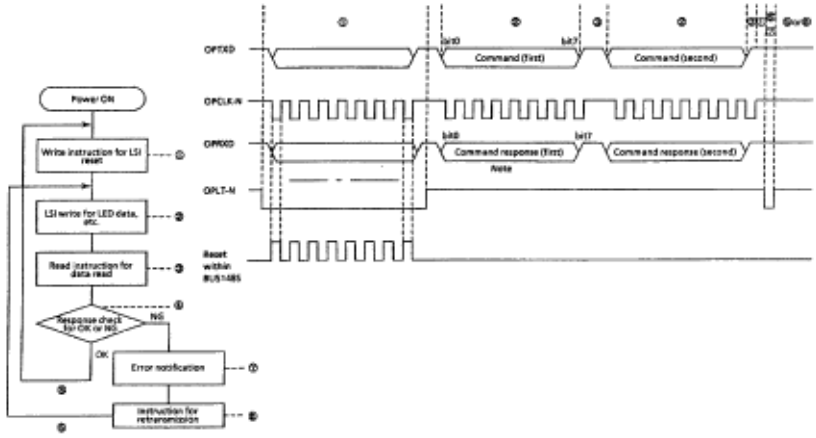
As the space motor operates, the encoder disk spins. When the encoder disk interrupts the photo sensors, the signals Phase A and Phase B are generated. The LSI (Location 02D: MSM79V035) divides these edge pulse signals (the frequency division is based on the selected print pitch) to generate the signal IPT. The IPT signal provides dot-on timing and carriage position detection timing.

2.1.07 Operation Panel

The Serial I/O Port (Ports 20 - 23) of the MPU reads the operation panel switch data from the operation panel control LSI (Location IC1: BUS148S). The Serial I/O Port also outputs LED data to the operation panel control LSI.

A two byte (15 bits +1 parity bit (even parity)) command (OPTXD) is transmitted from the MPU to the operation panel LSI in synchronization with the OPCLK signal. Once the LSI decodes the command, the command must pass a command code check and have no parity errors. Then, the specified I/O control will return the two byte command response to the MPU.



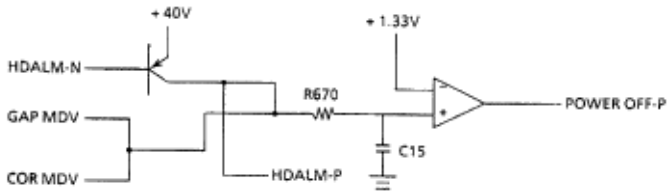


Note : From the illustration above, you can see that the command and the command response are output at the same time. This is because the bit 0 to bit 3 of OPRXD are fixed so that the response can be returned before decoding the command.

2.1.08 Alarm Circuit

Driver Circuit Alarm Processing

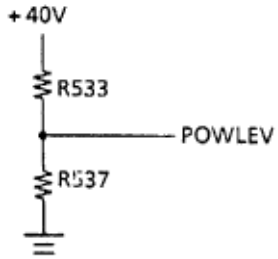
The printhead driver output, the head gap magnet output and the color ribbon magnet drive signal are monitored at R670 and C15, and the POWER OFF-P signal is output by the comparator (Location 01A: IC2901) when driven for more than the specified time. This signal becomes the ALM signal. The ALM signal is sent to the power supply board and causes the DC voltages to be turned off.



Low Motor Drive Voltage Alarm

+40V is converted into the POWLEV signal (0 vdc to +5 vdc) by the voltage divider network of R533 and R537, then input to the A/D port of the MPU. The value of this voltage is used to control the drive time and the print speed (pass number) of the head.

2-20.pcx



Head Drive Time

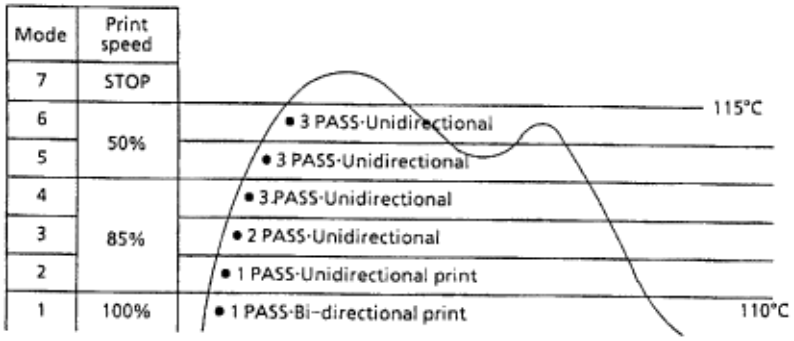
The head drive time is modified to compensate for the amount of the voltage drop of the POWLEV signal. By monitoring the voltage drop every 500 microseconds, the MPU is able to control and maintain the impact necessary for each printhead pin.

Print Speed

Actual Voltage (+40 vdc)	Passes Required	Relative Print Speed
+34 vdc or greater	1	100%
+32 vdc to +34 vdc	1	Approximately 85%
+30 vdc to +32 vdc	1	Approximately 50%
+30 vdc or less	2	Less than 50%

Head Overheat Alarm Processing

Two thermistors are used to monitor the printhead temperature. One is contained in the printhead and the other in the printhead driver. The voltage of the TSD signal is monitored at the MPU A/D port to control the pass number and print method (unidirectional / bi-directional) at each of seven levels. If the printhead temperature exceeds 110 degrees Celsius, the printer will switch to unidirectional print. If the temperature exceeds 115 degrees Celsius, printing will stop. Once the printhead cools, printing will resume.



2.1.09 Power Supply Circuit

The switching type power supply circuit supplies the +5 vdc, +/-8 vdc, +12 vdc and +40 vdc.

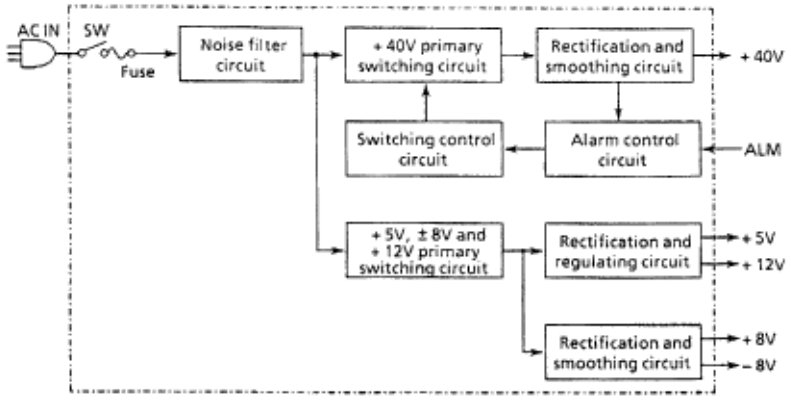


Table of Output Voltages

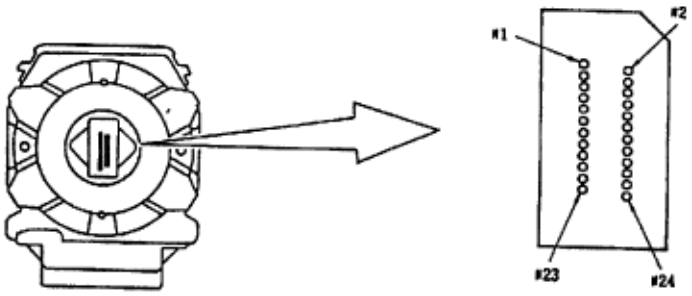
Voltage / Signal	Purpose
+5 vdc	IC logic levels LED drive voltages
+8 vdc	Serial interface line voltage comparator IC
-8 vdc	Serial interface line voltage
+12 vdc	Printhead analog circuit
+40 vdc	Printhead space motor and line feed motor drive voltage
ALM	Output from the main control board upon detection of an abnormality in the printhead head gap or color ribbon drive circuits. This signal will cause all DC voltages to be turned off.

2.2 MECHANICAL OPERATION

The following section explains the mechanical operation of the printer.

2.2.01 Printhead Mechanism

The printhead is a spring charged 24-pin printhead. It is attached to the carriage, which moves parallel to the platen. Electrically, the printhead is controlled by the main control board via the carriage cable and the space motor.

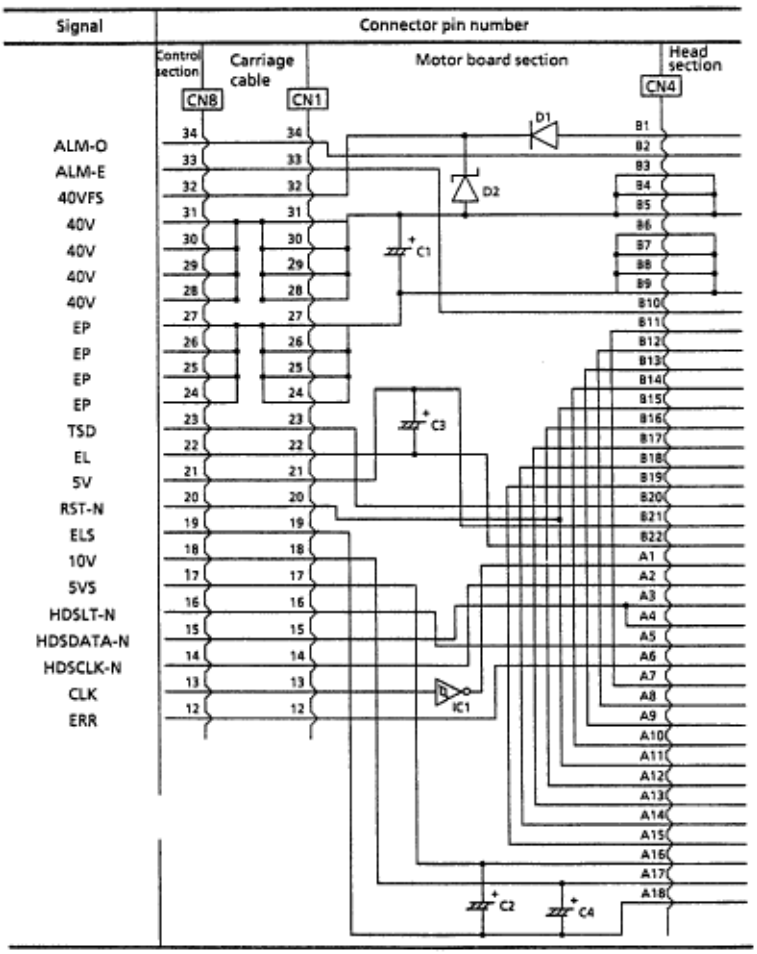


Arrangement of the head pins
View from the tip of the printhead

Interconnect Diagram: Control Board to Printhead

Note: The printhead coil resistance values ARE NOT LISTED.

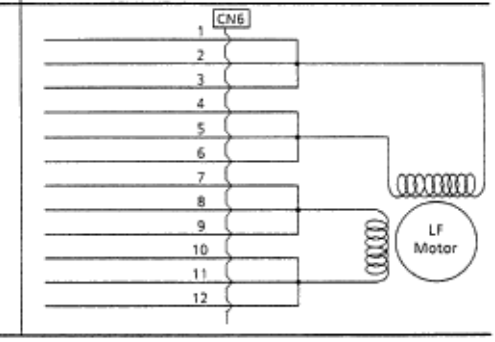
The individual print wire control lines CANNOT be accessed on this printhead.



Line Feed Motor Resistance

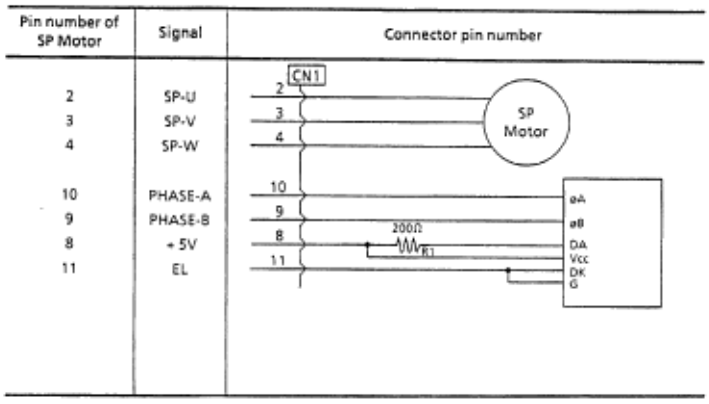
The resistance of each coil should be approximately 13 ohms.

Pin number of LF Motor	Signal	Connector pin number
1	LF1	
2	LF1	
3	LF1	
4	LF2	
5	LF2	
6	LF2	
7	LF3	
8	LF3	
9	LF3	
10	LF4	
11	LF4	
12	LF4	



Space Motor Resistance

The resistance of each coil should be approximately 5 ohms.



Printhead Operation

When the printhead is idle, the armature is attracted to the permanent magnet. The print wires, which are attached to each armature, are then concealed inside the wire guide.

When a signal to print a character is received, current flows through a coil. The magnetic field generated by the coil opposes the magnetic field between the armature and the permanent magnet. The armature is then driven in the direction of the platen by the force of the armature spring. The print wire, which is attached to the armature, protrudes from the tip of the wire guide, strikes the paper through the ribbon and prints a dot on the paper.

As the armature gets closer to the electrode of the analog sensor, the capacitance between them increases and a small amount of current flows. This current is amplified and sent to the logic control LSI to indicate armature activity. In order to attain optimum drive time, this information is transferred to the MPU. The MPU continually modifies the head gap to maintain the optimum drive time condition.

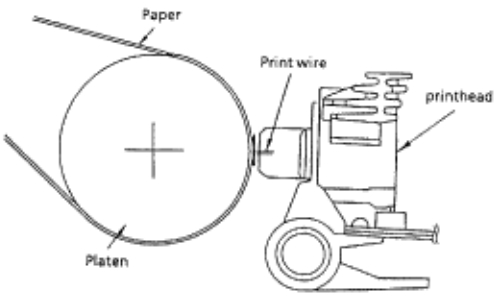
The analog sensor element monitors all of the pins. The difference in pin stroke due to the curvature of the platen is compensated for at the logic control section of the printhead and is not transferred to the MPU.

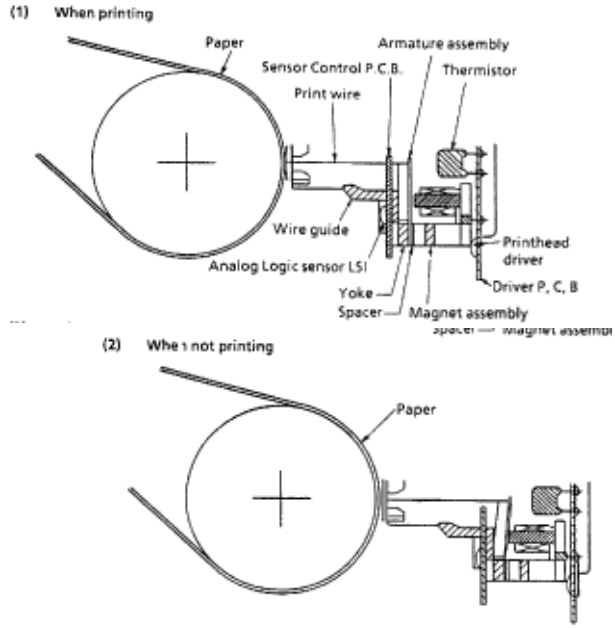
After the character has been printed, the permanent magnet attracts the armature and the print wires are retracted into the wire guide.

Two thermistors are used to monitor the printhead temperature.

A thermistor in the printhead prevents over-heating of the coil during periods of continuous bi-directional printing. If the printhead temperature exceeds 110 degrees Celsius, the printer will switch to unidirectional print. If the temperature exceeds 115 degrees Celsius, printing will stop. Once the printhead cools, printing will resume. When the temperature of the coil exceeds the pre-determined limits, the control circuit detects the thermistor signal (TSD).

A thermistor in the printhead driver monitors the temperature of the driver. If the temperature of the driver exceeds the pre-determined limits (110 degrees Celsius - unidirectional printing / 115 degrees Celsius - printing stops) the control circuit detects the thermistor signal (TSD). The voltage of the TSD signal is monitored at the MPU A/D port to control the pass number and print method (unidirectional / bi-directional) at each of seven levels.





2.2.02 Spacing Mechanism

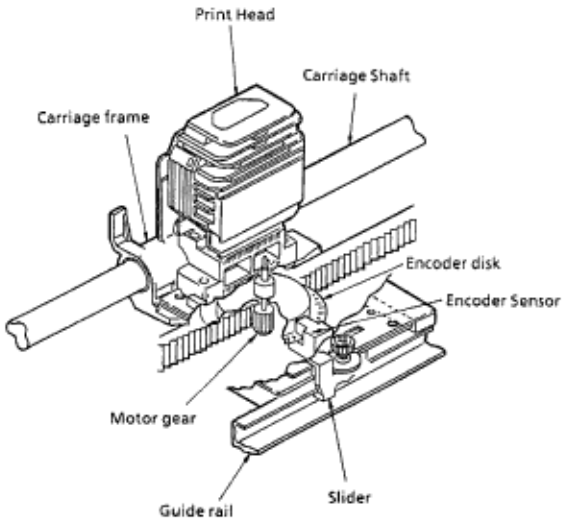
The spacing mechanism consists of a carriage shaft (mounted parallel to the platen), and a carriage frame which moves along the shaft. The carriage frame is driven by a DC servo motor mounted on the carriage frame. Items included in the spacing mechanism are listed below.

Space Motor Assembly
DC Servo Motor
Motor gear
Sensor
Encoder Disk
Carriage Frame
Carriage Shaft
Space Rack
Spacing Operation

The carriage frame, which contains the printhead and space motor, moves along the carriage shaft parallel to the platen. When the space motor rotates, the driving force is transmitted to the motor gear. As the motor gear rotates, the carriage moves along the platen. For every revolution of the DC servo motor, the carriage frame moves 0.8 inch (20.32 mm).

As the DC servo motor rotates, a slotted disk (called the encoder disk), passes between a light source and two photosensors. The position of the carriage frame can be determined by counting the pulses generated by the photosensors.

In the same way, the rotation of the space motor can be recognized and controlled by measuring the phase relationship and the pulse width of the signals generated by the photosensors.



2.2.03 Head Gap Mechanism

The head gap is automatically set for the thickness of the medium loaded in the printer. In the case of envelopes, where the medium thickness varies as the printhead moves along the platen, the head gap changes to compensate for the differences in thickness.

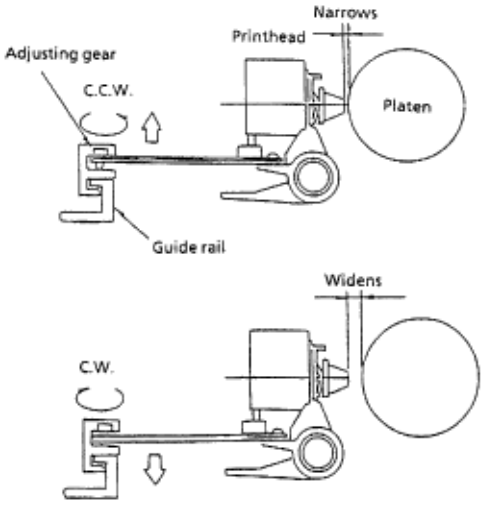
Head Gap Setting Operation

Once printing starts, the space motor rotates the ribbon gear, causing idle gear C to turn the change gear.

When the MPU requests a change in the head gap setting, the GAP-P signal causes the armature (which is holding the change gear) to be attracted to the pranger magnet. The gap reset spring can now push the change gear so it contacts the gap change gear.

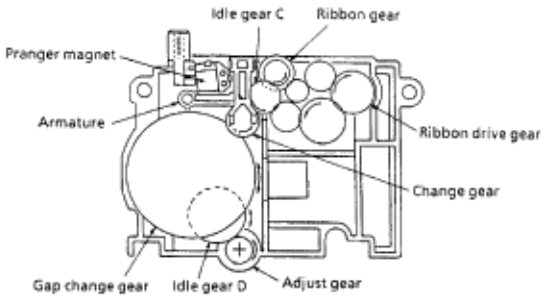
The rotation of the gap change gear causes idle gear D to turn the adjust gear. The adjust gear turns the adjusting screw, resulting in a new head gap setting.

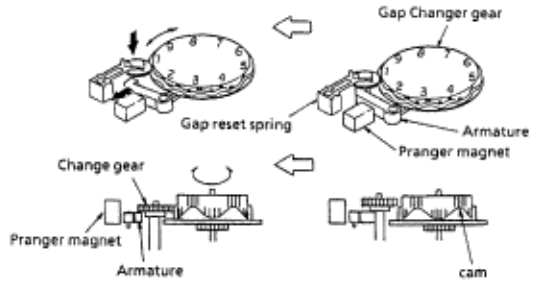
Note: As the adjusting screw turns counter-clockwise, the gap narrows.
As the adjusting screw turns clockwise, the gap widens.



There is a cam at each setting of the gap change gear. When the change gear is at the top of the cam, the change gear disengages from the gap change gear. At this time, the armature resets, changing the head gap by one setting.

The head gap is modified in .06 mm units for each range setting.





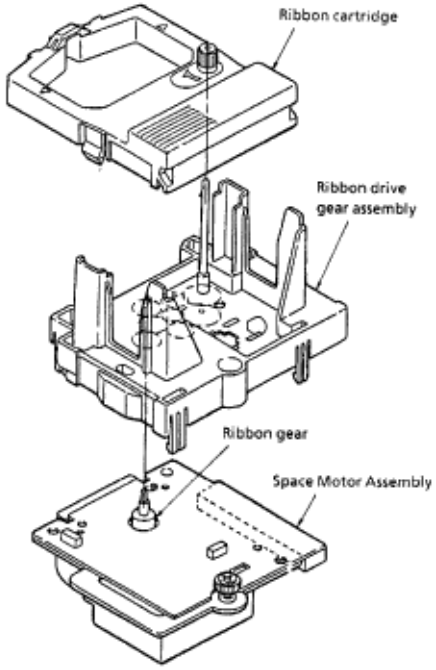
2.2.04 Ribbon Drive Mechanism

Black Ribbon Drive Operation

The ribbon drive mechanism feeds the ribbon in synchronization with the spacing operation. The force required to drive the ribbon is obtained from the space motor.

The ribbon drive mechanism is composed of the following items.

Ribbon drive gear assembly
Ribbon gear (located on the space motor assembly)
Ribbon cartridge



A continuous loop ribbon with uni-directional feed is used. Ink is supplied from an ink tank, which is built into the ribbon cartridge.

When the space motor turns, the ribbon gear on the spacing motor shaft rotates. The rotation is transmitted via a combination of gears, from the ribbon drive gear assembly to the drive gear in the ribbon cartridge.

Although the space motor moves in both the forward and reverse directions during bi-directional printing, the gears in the ribbon drive assembly maintain uni-directional ribbon feed by switching the rotation direction of the gears.

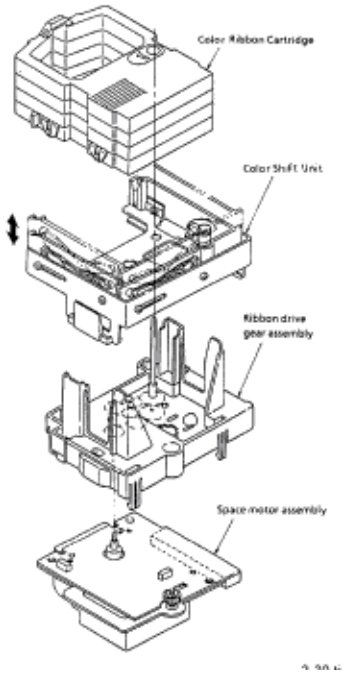
Partner Exchange (BPX) for any updates to this material. (http://bpx.okidata.com)

Color Ribbon Shift Mechanism

Items of the color ribbon unit option are listed below.

Color shift unit
Color ribbon (4 colors)

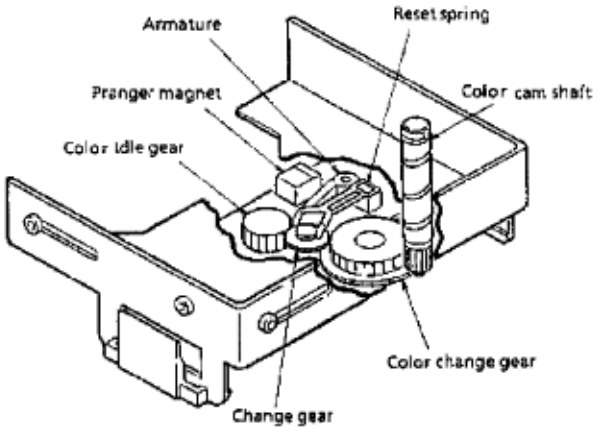
Four colors can be selected by sliding the color ribbon holder up or down. Here is a description of how the ribbon holder is shifted.



As the space motor moves, idle gear C on the ribbon drive unit rotates. Idle gear C rotates the color idle gear, located in the color shift unit.

When the color-P signal from the main control board activates the pranger magnet, the magnet attracts the armature. This causes the reset spring to force the change gear downward. The color idle gear rotates the change gear, which turns the color change gear. The color change gear turns the color cam shaft. The rotation of the color cam shaft moves the color ribbon holder up/down to select the desired ribbon color.

There is a cam at each setting of the color change gear. When the change gear is at the top of the cam, the change gear disengages from the color change gear. At this time, the armature resets, changing the color band selection by one setting.

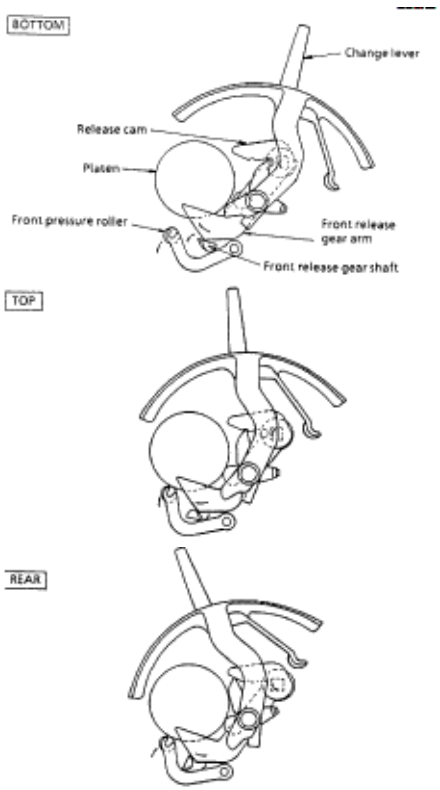


2.2.05 Line Feed Mechanism

The line feed operation is accomplished by activating the line feed motor which turns the platen. The rotation of the platen is used to feed paper from the selected paper path.

Components of the paper feed mechanism are listed below.

Line Feed Motor (pulse motor) with Gears
Line Feed Idler Gear



Platen
Rear Tractor Feed Unit
Pressure Roller
Change Lever (Paper Path Selection Lever)

The change lever is used to select one of three different paper paths; top, rear or bottom.

Paper Clamp Mechanism

Moving the Change Lever between the Bottom, Top and Rear positions, changes the positions of the Front Release Gear Arm and the Release Cam.

The movement of the Front Release Gear Arm changes the position of the Front Release Gear Shaft. This causes the Front Pressure Roller to open or close.

The movement of the Release Cam causes the Rear Pressure Roller to open or close.

Position of Change Lever	**Status of Front Pressure Roller**	**Tension of Front Pressure Roller**	**Status of Rear Pressure Roller**	**Tension of Rear Pressure Roller**
Bottom	OPEN	N/A	OPEN	N/A
Top	CLOSED	250 g	CLOSED	700 g
Rear	CLOSED	90 g	OPEN	N/A

Cut Sheet/Continuous Sheet Switching Mechanism

Top Feed (for cut sheet paper)

When cut sheet paper is used, place the change lever in the Top Feed position.
As the platen turns, the platen gear causes the idle gear to rotate.
At this time, the rear and front pressure rollers press against the platen and feed the cut sheet.

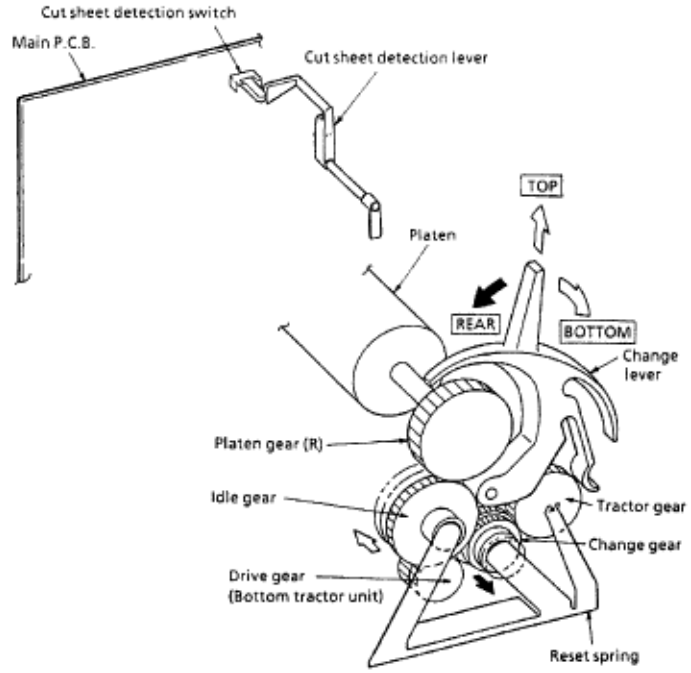
The cut sheet detection lever enables the cut sheet detection switch, which is located on the main control board. This places the printer in the cut sheet mode.

When cut sheet paper is placed between the platen and the paper chute, the printer automatically feeds the sheet to the print start position.

Rear/Bottom Feed (for continuous feed paper)

When the continuous feed paper is used, either with the rear tractor, optional bottom tractor or optional pull tractor, place the change lever in the Rear/Bottom Feed position.

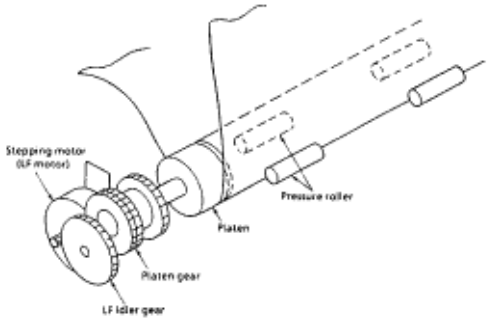
When the change lever is placed in this position, the reset spring pushes the change gear. In this position, the idle gear is engaged with the bottom tractor unit drive gear and the tractor gear. As the platen turns, power is transferred from the platen gear - to the idle gear - to the change gear - and to the push tractor shaft.



Cut Sheet Paper Feed Operation

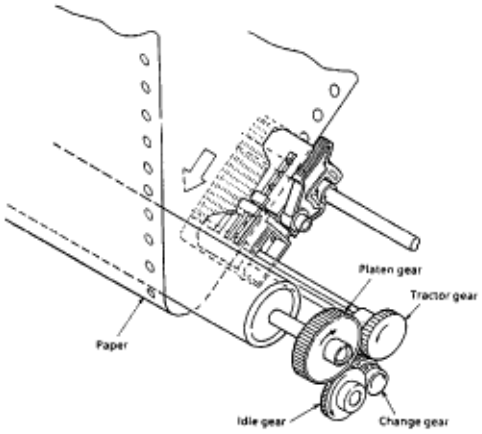
As the line feed motor rotates, power is transferred through decelerating gears (line feed idler gear, platen gear) to the platen.

When using cut sheet paper, the change lever must be in the **TOP** position so the platen and pressure rollers can feed the paper. This also disengages the push tractor.



Continuous Paper Feed (Rear Tractor Mechanism)

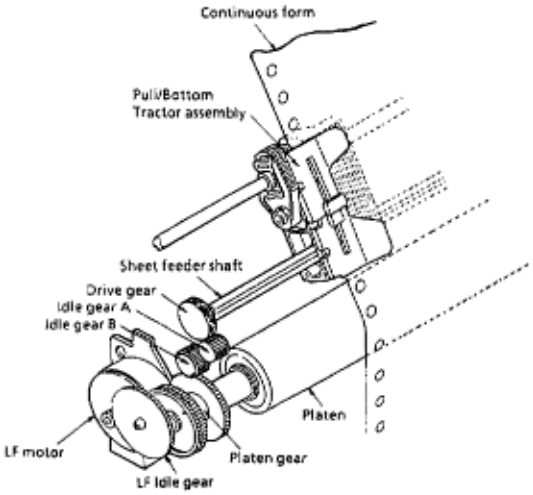
As the platen rotates, power is transferred to the tractor gear from the platen gear, the idler gear and the change gear. The tractor gear drives the pin tractor belts which feed the continuous paper.



Continuous Paper Feed (Pull Tractor Mechanism)

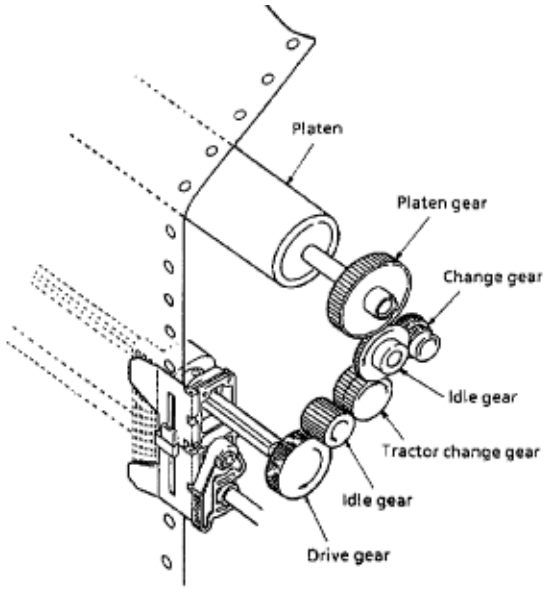
Bottom feed of continuous sheets is possible only when an optional pull tractor unit is installed.

As the platen rotates, power is transferred to the drive gear from the LF idler gear, the platen gear, idler gear B and idler gear A. The drive gear turns the pull tractor assembly which feed the continuous paper.



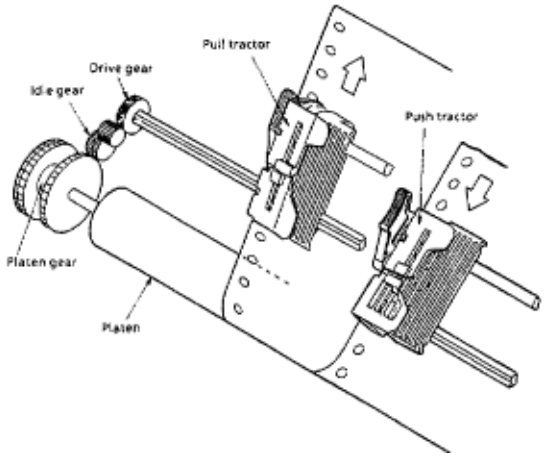
Continuous Paper Feed (Bottom Tractor Feed Mechanism)

As the platen rotates, power is transferred to the drive gear from the platen gear, the idle gear and the tractor change gear. The drive gear turns the pin tractor belts on the bottom tractor feed unit to feed the continuous paper.



Continuous Paper Feed (Push/Pull Tractor Mechanism)

This mechanism consists of an optional pull tractor and a standard push tractor mechanism. Continuous paper is fed by these two tractors at the same time.



2.2.06 Paper Detection Mechanism

Top Feed Paper Detection

When the cut sheet paper is inserted into the printer, Point A of Paper Near End Lever - B is pushed backward rotating Paper Near End Lever - A.

As Paper Near End Lever - A rotates, it contacts the Rear Sensor Lever, rotating it.

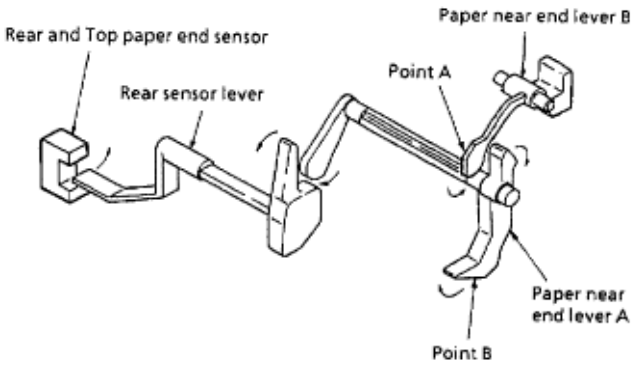
The Rear Sensor Lever rotates, unblocking the Rear / Top Paper End Sensor.

Rear Feed Detection

When paper is fed from the rear push tractor, Point B is pushed backward rotating Paper Near End Lever - A.

As Paper Near End Lever - A rotates, it contacts the Rear Sensor Lever, rotating it.

The Rear Sensor Lever rotates, unblocking the Rear / Top Paper End Sensor.



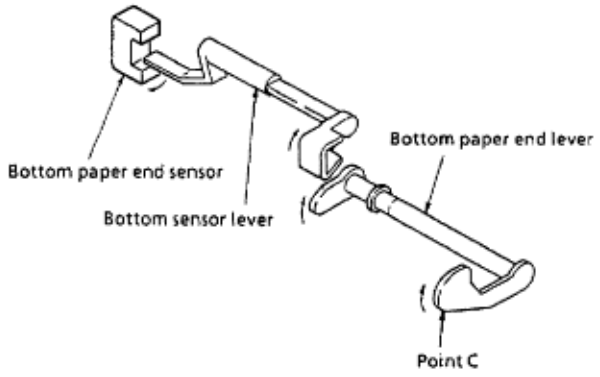
Bottom Feed Detection

When the paper is fed from the bottom of the printer, Point C is pushed, rotating the Bottom Paper End Lever.

As the Bottom Paper End Lever rotates, it contacts and rotates the Bottom Sensor Lever.

The Bottom Sensor Lever rotates, unblocking the Bottom Paper End Sensor.

Note: The method for detecting a paper-end condition is in the reverse order, that is, paper-end is detected when the Paper End Sensor is blocked.



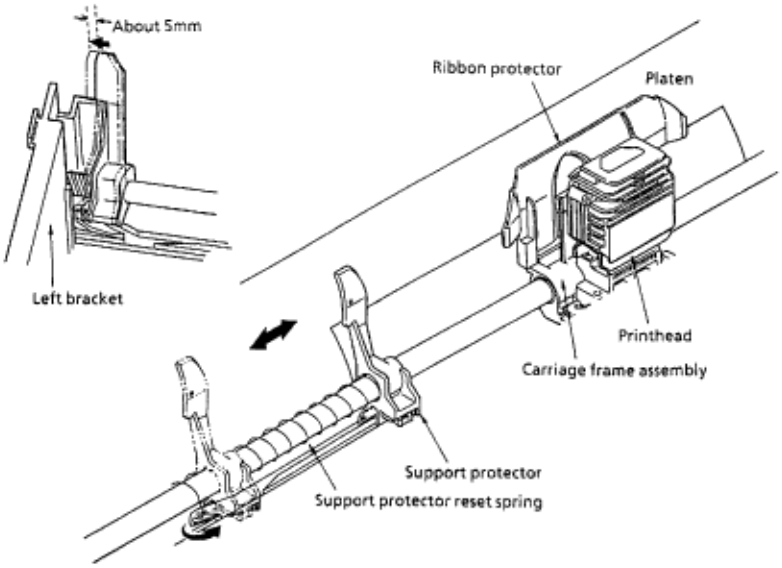
2.2.07 Support Protector Mechanism

During printer initialization, the support protector is latched in the stored position (approximately 5 mm from the left bracket of the main frame).

Just before paper is loaded, the printhead moves towards the left bracket and unlatches the support protector.

As the printhead moves to the right, the support protector reset spring pushes the support protector toward the center of the platen. With the support protector in this position, the ribbon protector and the support protector prevent the leading edge of the paper from curling or folding.

Once the paper is ejected, the printhead slowly moves towards the left bracket. The support protector is latched in the stored position when it is pushed to approximately 5 mm from the left bracket.



2.2.08 Automatic Paper Load

The Microline 590/591 printers will automatically detect cut sheet paper and feed the paper to the **TOP OF FORM** position.

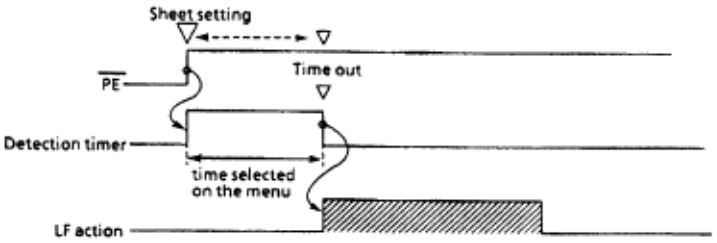
Cut Sheet Paper

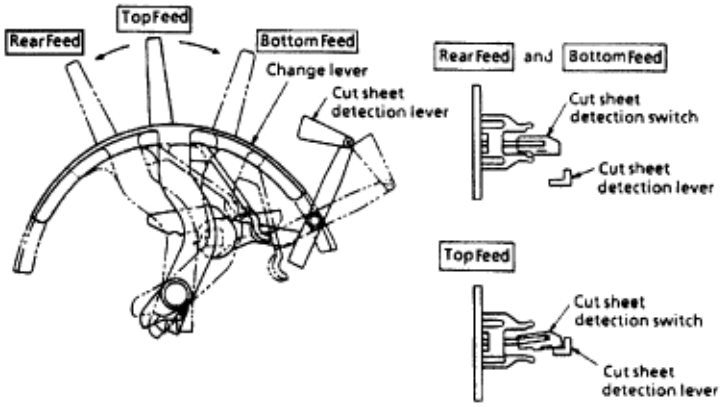
Set the change lever to the **TOP FEED** position.

Note: When the change lever is in the **TOP FEED** position, the cut sheet detection lever contacts the cut sheet detection switch (BASW) which is located on the main control board.

Insert the sheet of paper between the platen and the paper chute.

Once paper is detected at the paper end sensor and the amount of time selected on the **Wait Time** setting of the menu has lapsed, the line feed motor will feed the paper until the leading edge of the paper reaches the top of form position.





Continuous Feed Paper

Set the change lever to either the **REAR FEED** or **BOTTOM FEED** position.

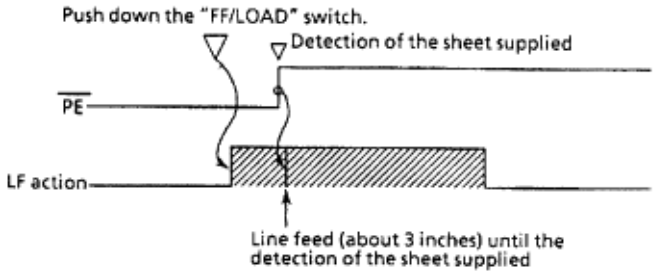
NOTE:

When the change lever is in the **REAR FEED** or **BOTTOM FEED** position, the cut sheet detection lever does not contact the cut sheet detection switch (BASW) which is located on the main control board.

Place continuous feed paper in the appropriate tractor.

Press the "**FF/LOAD**" switch.

The line feed motor will feed the paper until the leading edge of the paper to the top of form position.



2.2.09 Paper Park

If continuous feed paper is installed and printing on cut sheet paper is desired, it is not necessary to unload the continuous feed paper. The Paper Park feature provides a means of retracting the continuous feed paper from the paper path, to allow feeding of the cut sheet paper.

Paper Park Operation

Make sure the change lever is in the REAR FEED or BOTTOM FEED position.

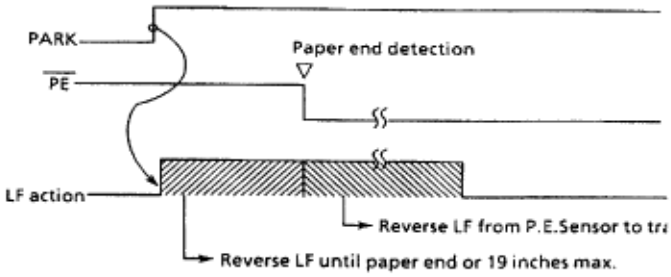
Press the "**PARK**" switch on the operation panel.

A reverse line feed operation retracts the paper until paper-end occurs or 19 inches of paper have been retracted.

Note: Retracting 19 inches of paper without detecting a paper-end condition causes the line feed operation to stop. The line feed operation stops because the printer assumes a jam has occurred.

The operator can press the **SEL** switch to reset the **ALARM LED** and press the **PARK** switch to continue the park operation.

This operation may be useful when length of the paper to be parked is greater than 19 inches.



3.1.01 General Information

This section lists the parts replacement, adjustment, cleaning, lubrication, and shipping procedures.

Disassembly should not be performed unless absolutely necessary. **NEVER** perform disassembly on a malfunctioning printer until you have followed the failure analysis procedures in Section Four of this Service Handbook.

Follow the procedures listed in Adjustments and Service Settings. Adjustments may be required when either consumable or parts are replaced. Failure to perform these procedures could result in unnecessary service calls.

Proper performance of maintenance and cleaning will help to achieve the best possible print quality from the printer.

3.1.02 Maintenance Tools

The following tools are required to service the printer.

#2 Phillips Screwdriver (with magnetic tip)
Straight-slot Screwdriver
Needle Nose Pliers (4 Inch)
Wire Cutters
Digital Multimeter
Feeler Gauge (capable of measuring .014 inches)
Shop Vacuum
Clean, soft, and lint-free Cloth
All-Purpose Cleaner
Contact Kleen **(Okidata P/N 51802301)**
Platen Cleaner
Machine Grease
Machine Oil

3.1.03 Maintenance Precautions

1. Do not disassemble the unit if it is operating normally.
2. Before starting disassembly and assembly, always turn the AC power switch OFF and pull out the AC plug.
3. Detach the interface cable, if installed.
4. Do not remove parts unnecessarily. Try to keep disassembly to a minimum.
5. Use the recommended maintenance tools.
6. When disassembling, follow the listed sequence. Failure to follow the correct sequence may result in damaged parts.
7. Since screws, collars and other small parts are easily lost, they should be temporarily attached to the original positions.
8. When handling circuit boards use extreme care. Integrated circuits (microprocessors, ROM, and RAM) can be destroyed by static electricity.
9. Do not place printed circuit boards directly on conductive surfaces.
10. Follow the recommended procedures when replacing assemblies and units.
11. Perform the printhead gap adjustment procedure Refer to Section 3.3 of this Service Handbook when the any of the following occur.

Print Quality is darker on one side of the document.
Parts are replaced:

1. Printhead(3.2.02)
2. Space Motor Assembly(3.2.11)
3. Space Rack(3.2.13)
4. Guide Rail(3.2.15)
5. Platen Assembly(3.2.19)
6. Carriage Shaft(3.2.25)

3.2 DISASSEMBLY/ASSEMBLY PROCEDURES

General Information

This section contains the printer disassembly procedures. Only the removal procedures are explained here. Reverse the procedure for the installation.

At the bottom of each procedure is a listing of the parts covered in that procedure. The Okidata part number, item description, comment (RSPL, Option, Consumable) and cross-reference to Appendix B is provided for each part. Items included in the Recommended Spare Parts List are indicated by the acronym RSPL. N/A will appear where a part number is not available.

590 indicates that the item is specific to the Microline 590.

591 indicates that the item is specific to the Microline 591.

Both indicates that the item is common to both printers.

Part Number	Description	Item	Comment	Appendix B Reference

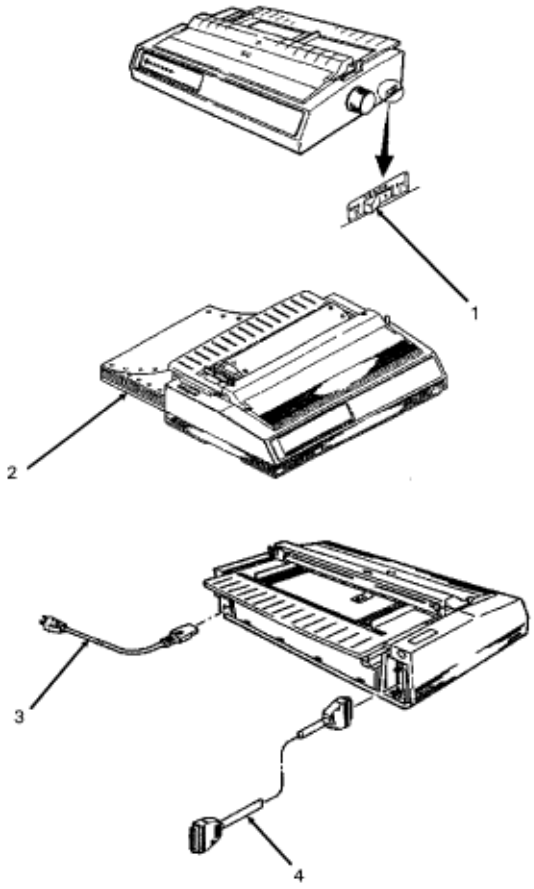
This Service Handbook lists the disassembly procedures for major components of the unit. Okidata **DOES NOT** recommend disassembling a unit which is operating normally. If you decide to perform disassembly during this training, Okidata recommends that you perform only the disassembly procedures for RSPL items. All other procedures are provided to assist you in identifying parts. It is not likely that you will perform these procedures while servicing the unit.

Be sure to read all notes, cautions, and warnings, as they contain important information regarding disassembly / assembly.

3.2.01 Preliminary Items

1. Press the AC switch (1) and power off the printer.
2. Remove the paper, if installed (2).
3. Detach the AC power cord (3).
4. Detach the interface cable, if installed (4).

P/N 56609701	Cord: AC	RSPL	Both	B.2.02
P/N 56624101	Cord: AC 220V (ML Series) Right Angle	Option RSPL	Both	B.2.02
P/N 56624401	Cord: AC 240V	Option RSPL	Both	B.2.07
P/N 70000803	Kit: Parallel Interface Plug'n'Play Accessory	Option	Both	B.2.07
P/N 70012801	Kit: RS232-C Serial Interface	Option	Both	B.2.07



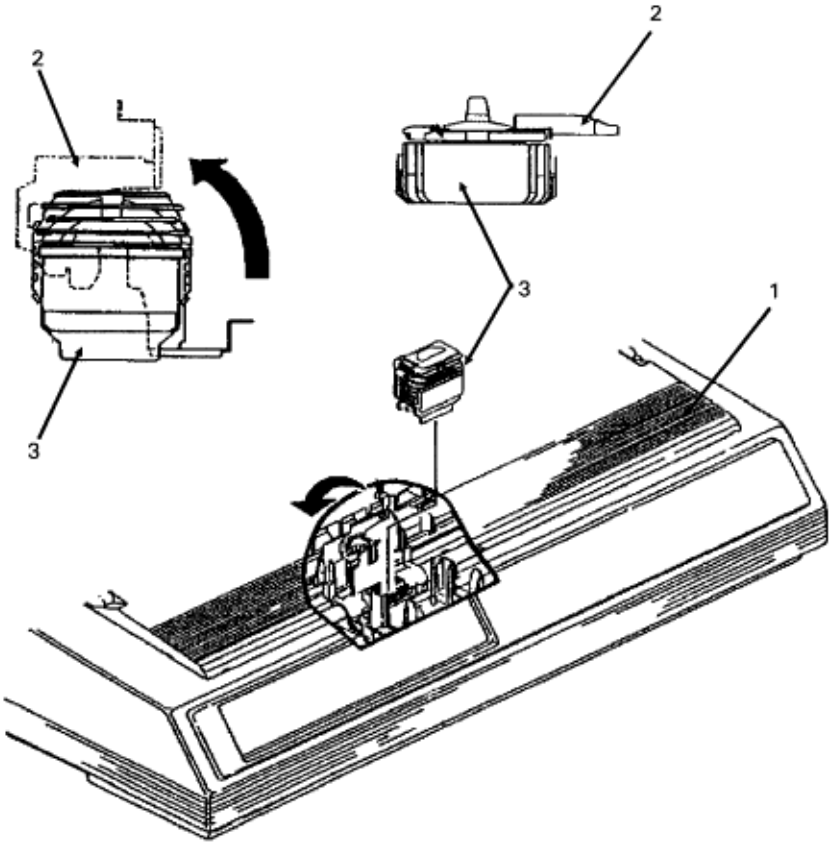
3.2.02 Printhead Assembly

1. **Perform this procedure: 3.2.01.**
2. Open the access cover (1).
3. Lift and remove the ribbon. (Not shown)
4. Pull the head clamp (2) towards the right and then rotate it up to release the printhead (3).
5. Pull the printhead straight up to remove it.

NOTE:

Installation
After installing the printhead, check the printhead gap adjustment. **Refer to Section 3.3 of this Service Handbook.**

P/N 52106001	Ribbon: Black	Consumable	Both	B.2.09
P/N 52106002	Ribbon: Color	Consumable	Both	B.2.09
P/N 50707401	Clamp: Head	RSPL	Both	B.2.06
P/N 50217201	Assembly: Printhead	RSPL	Both	B.2.02



3.2.03 Ribbon Protector

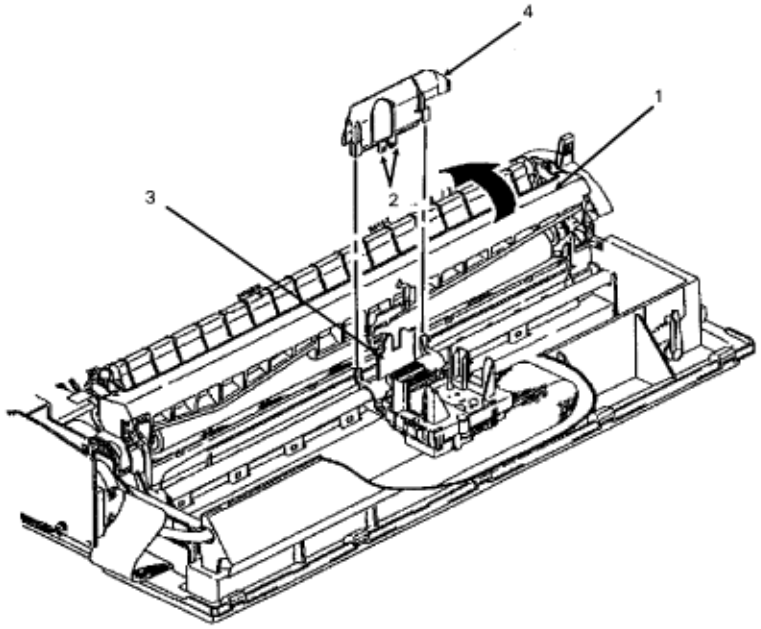
CAUTION
You MUST use a straight slot screwdriver to release the ribbon protector. If you attempt to lift the protector without releasing the tabs, the protector will break.

1. Perform these procedures:

   3.2.01
   3.2.02

2. Open the pull-up roller cover (1).
3. Use a straight-slot screwdriver to release the extensions (2) from the carriage frame set (3).
4. Lift the ribbon protector (4) straight up and remove it.

P/N 53562801 Protector: Ribbon RSPL Both B.2.06



3.2.04 Gear Case Assembly

1. Perform these procedures:

   3.2.01
   3.2.02

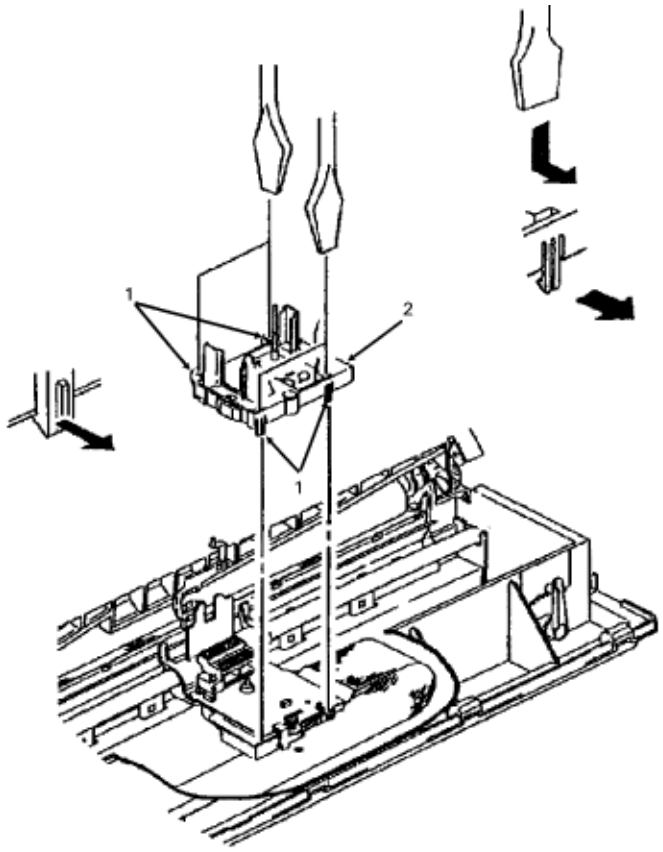
2. Use a straight-slot screwdriver to release the four claws (1) of the gear case assembly (2).

3. Lift and remove the gear case assembly.

NOTE:

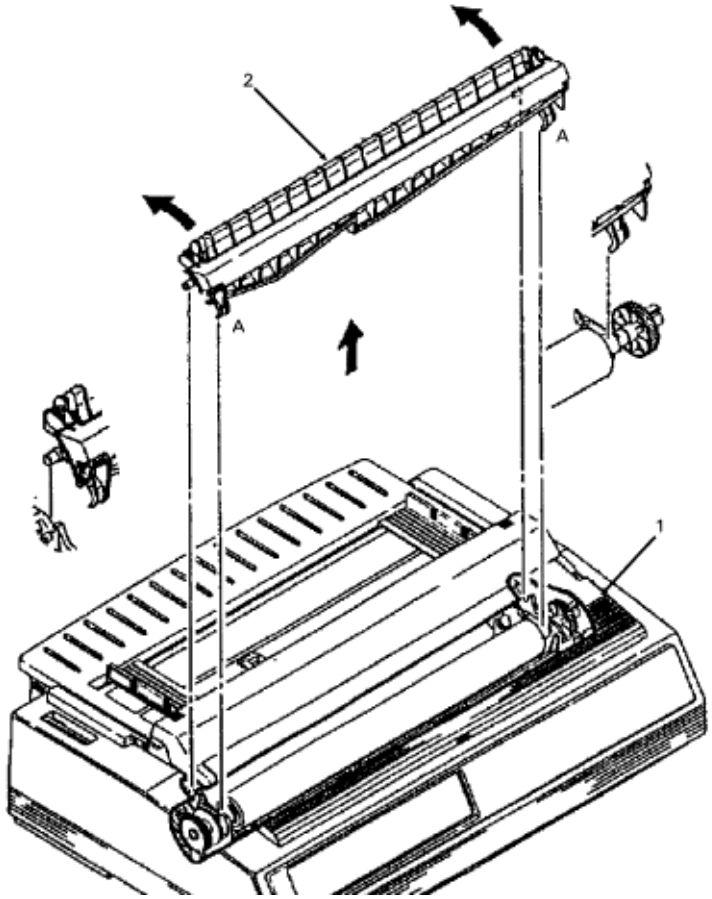
Lubrication
When lubricating, **refer to Section 3.5 of this Service Handbook.**

P/N 51228501 Gear: Case (Assembly) RSPL Both B.2.06



3.2.05 Pull-up Roller Assembly

1. Perform this procedure:
   3.2.01
2. Open the access cover (1).
3. Open the cover of the pull-up roller assembly (2).
4. Press at A while rotating the assembly towards the back of the printer.
5. Remove the assembly.



NOTE:

Lubrication
When lubricating, **refer to Section 3.5 of this Service Handbook.**

P/N 53341501 Roller: Pull Up Assembly(Narrow) RSPL 590 B.2.04

3.2.06 Upper Cover, Access Cover, and Sheet Guide Assemblies

1. Perform this procedure:

   3.2.01

2. Pull the platen knob (1) straight out and remove it.

3. Set the change lever (2) to the bottom feed position (toward the rear of the printer).

4. Insert a flat-blade screwdriver into the grooves (3) of the frame and pry the upper cover (4) away from the frame.

5. Raise the front side of the upper cover assembly.

6. Tilt the upper cover assembly toward the rear to disengage the claws (not shown) at the rear of the frame.

7. Lift the upper cover assembly and remove it.

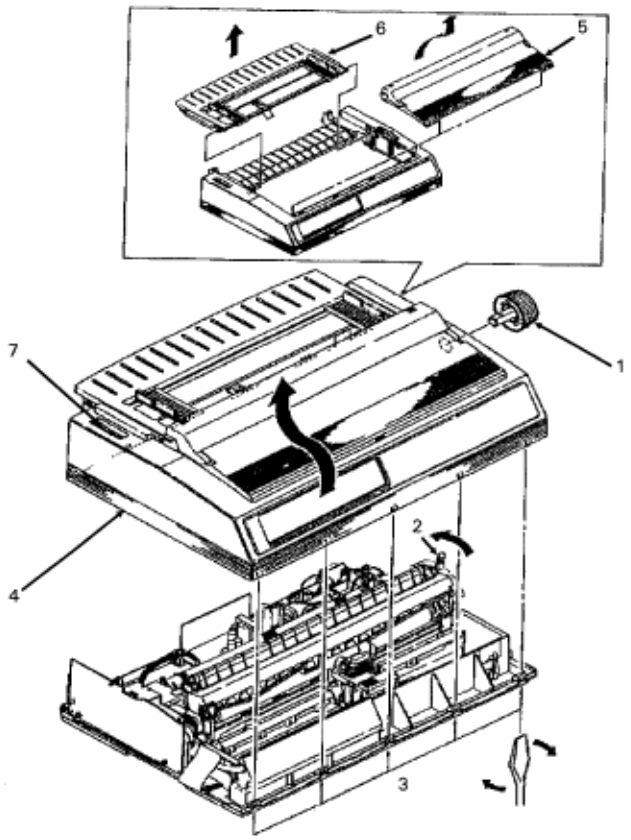
CAUTION:

Do not rotate the access cover past the vertical when removing it or you will break the tab extensions.

8. Raise the access cover assembly (5) until it is vertical, then lift it straight up to remove it.

9. Remove the sheet guide assembly (6).

10. Note the position of the cover (B) <for card slot> (7). This is part of the upper cover and should not be removed. No font cards are currently available.



NOTE:
When cleaning, **refer to Section 3.4 of this Service Handbook.**

P/N 51009401	Guide: Sheet (Narrow)	RSPL	590	**B.2.01**
P/N 51009501	Guide: Sheet (Wide)	RSPL	591	**B.2.01**
P/N 53066901	Cover: Upper (Narrow)	RSPL	590	**B.2.01**
P/N 53067001	Cover: Upper (Wide)	RSPL	591	**B.2.01**
P/N 53067101	Cover: Access (Narrow)	RSPL	590	**B.2.01**
P/N 53067201	Cover: Access (Wide)	RSPL	591	**B.2.01**
P/N 53067301	Cover: (B) for card slot	RSPL	Both	**B.2.02**
P/N 53562601	Knob: Platen (ML500 Series)	RSPL	Both	**B.2.02**

3.2.07 Control Board (AKGI)

1. Perform these procedures:

   3.2.01
   3.2.06

2. Remove the two screws (1).

3. Release the control board (AKGI) (2) from the bracket (3).

4. Tilt the board to access the connectors.

5. Detach connectors CN7 - operator panel (4), CN8 - carriage cable (5), CN3 - power supply (6), and CN6 - line feed motor (7).

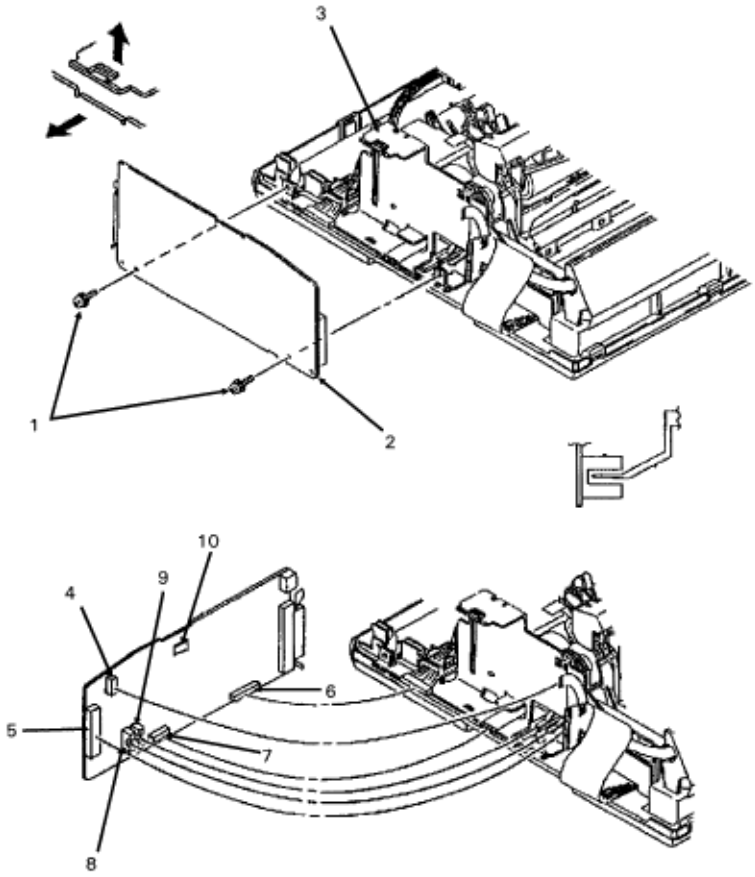
6. Remove the board.

NOTE:

Installation:
The bottom sensor lever must be positioned in the SNS3 sensor (8).

The rear sensor lever must be positioned in the SNS1 sensor (9).

The cut sheet/continuous sensor lever must be positioned below the BASW sensor (10). The lever should contact the sensor only when the change lever is in the top feed (middle) setting.
The IC: EEPROM is soldered in on the board.



P/N 55937401	PCB: AKGI (w/o ROM)	RSPL	Both	B.2.02
P/N 55938301	IC: EEPROM BR93CC46A	RSPL	Both	B.2.02

3.2.08 Power Supply Assembly

Perform these procedures:

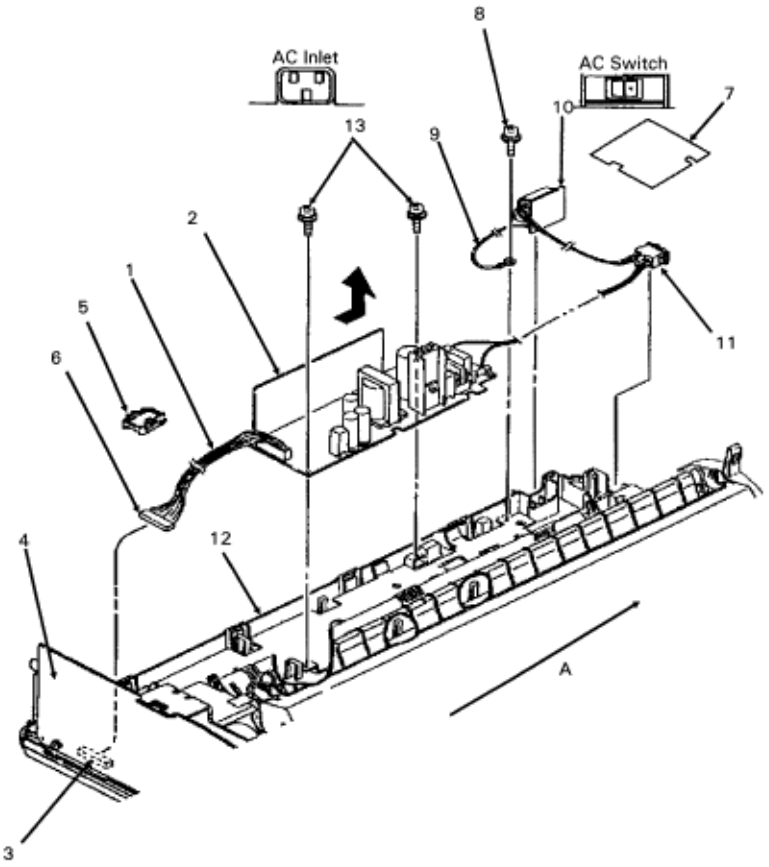
3.2.01
3.2.06

1. Detach the cable from connector CN2 (1) of the power supply board (2).
2. Detach the cable from connector CN3 (3) of the control board (4).
3. Use a straight slot screwdriver to release the claws and remove the cable clamp (5).
4. Remove the cable (6).
5. Release the tab and remove the cover (7).
6. Remove the screw (8) and detach the ground cable (9).
7. Lift the AC inlet (10) and the AC switch (11) from the main frame (12).
8. Remove the two screws (13).
9. Slide the power supply in the direction of arrow A to clear the claws of the base frame.
10. Lift and remove the power supply assembly.

NOTE:
The 5 amp fuse is on the end of the board facing the AC inlet and the AC switch.

The 2.5 amp fuse is near the middle of the board.

When installing, verify that the AC inlet and AC switch are oriented correctly.



P/N 50707501	Clamp: Cord	RSPL	Both	B.2.02
P/N 56302901	Fuse: 2.5A 120V	RSPL	Both	B.2.02
P/N 56305901	Fuse: (GGS 5) 120V	RSPL	Both	B.2.02
P/N 56306001	Fuse: 3.15 A (230/240V)	Option RSPL	Both	B.2.08
P/N 56306001	Fuse: 3.15 A (230/240V)	Option RSPL	Both	B.2.02
P/N 56412101	Power Supply 120V	RSPL	590	B.2.02
P/N 56412102	Power Supply 120V	RSPL	591	B.2.02
P/N 56412201	Power Supply 230-240V	Option RSPL	590	B.2.02/07
P/N 56412202	Power Supply 230-240V	Option RSPL	591	B.2.02/07

3.2.09 Operator Panel PCB (LEOP)

Perform these procedures:

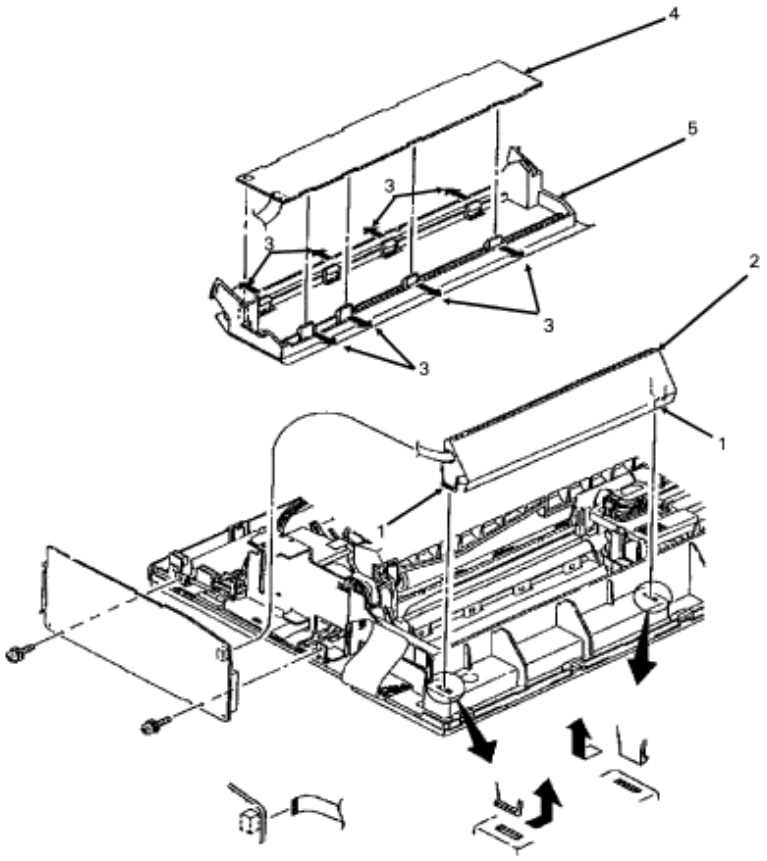
3.2.01
3.2.06
3.2.07

1. Cut the nylon tie and release the cable. (Not shown)

2. Disengage the claws (1) on both sides of the frame.

3. Lift the operator panel assembly (2) straight up and remove it.

4. Open eight claws (3) and remove the operator panel PCB (LEOP) (4) from the operator panel (5).



P/N 53562701 Panel: Operator RSPL Both **B.2.02**

P/N 55937501 PCB: LEOP (Operator Panel) RSPL Both **B.2.02**

3.2.10 PC Connector

1. Perform these procedures:

3.2.01
3.2.02
3.2.04

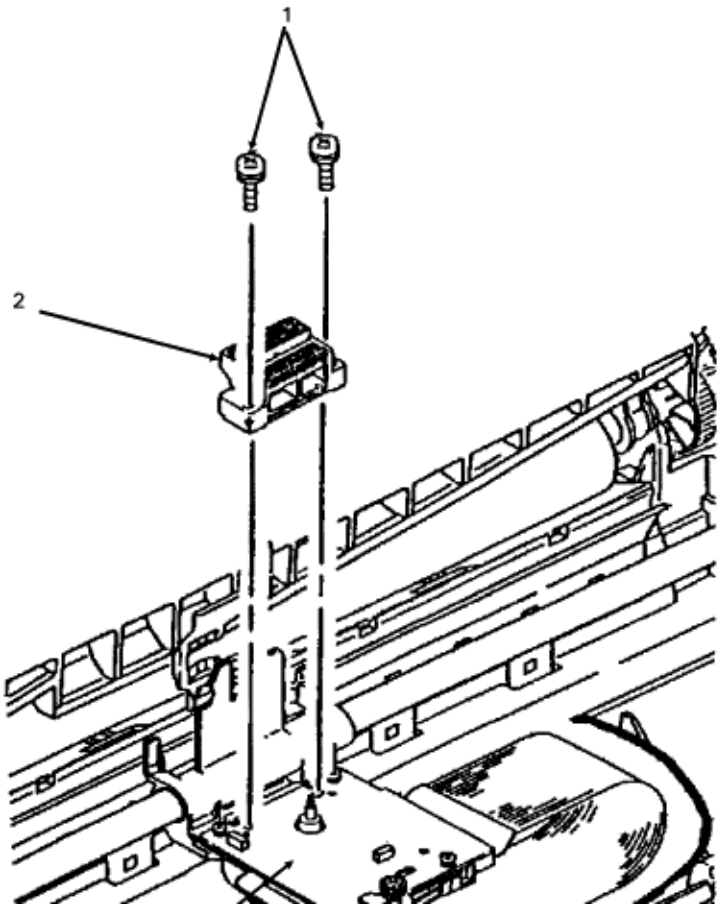
2. Remove the two screws (1).

3. Remove the PC connector (2).

NOTE:

Installation
Do not touch the contacts of the PC connector.
Do not touch the contacts of the space motor (3).

Cleaning
When cleaning, refer to Section 3.4 of this Service Handbook.



P/N 56729601 Connector: PC HD40 RSPL Both B.2.06

3.2.11 Space Motor and Roller Guide Assemblies

1. Perform these procedures:

   3.2.0
   3.2.02
   3.2.04
   3.2.10

2. Remove the three screws (1).

3. Lift the space motor assembly (2).

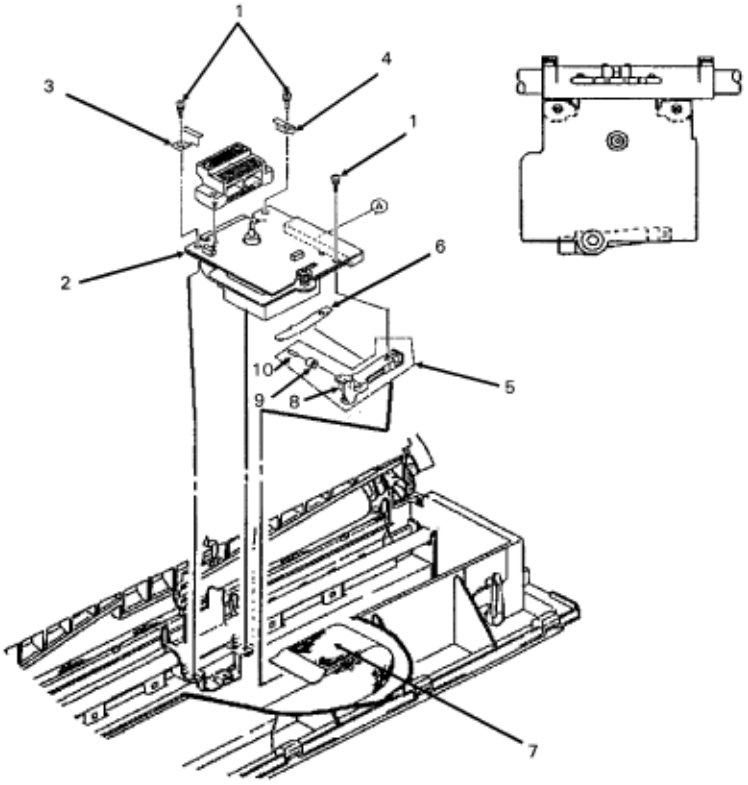
4. Remove the left (3) and right connector holders (4).

5. Remove the roller guide assembly (5) and guide roller spring (6).

6. Use firm pressure to pull the carriage cable (7) out to detach the cable from the space motor assembly.

7. Remove the space motor assembly.

NOTE:
The guide roller assembly includes the guide roller (8), the guide roller holder (9), and the pin 10). Installation Position the guide roller assembly first. The contact side of the cable faces down when the carriage cable is inserted into the connector on the space motor assembly. Work the cable from side to side until it is fully seated in the connector. No contacts should be visible. After installing the space motor assembly, check the printhead gap adjustment. **Refer to Section 3.3 of this Service Handbook.** **When lubricating, refer to Section 3.5 of this Service Handbook.**



P/N 53343001	Holder: Connector (L)	RSPL	Both	B.2.06
P/N 53343101	Holder: Connector (R)	RSPL	Both	B.2.06
P/N 56510401	Motor: Space Assembly	RSPL	Both	B.2.06
P/N 53343301	Guide: Roller Assembly		Both	B.2.06
P/N 53341901	Roller: Guide	RSPL	Both	B.2.06
P/N 53342001	Holder: Guide Roller	RSPL	Both	B.2.06
P/N N/APin			Both	B.2.06

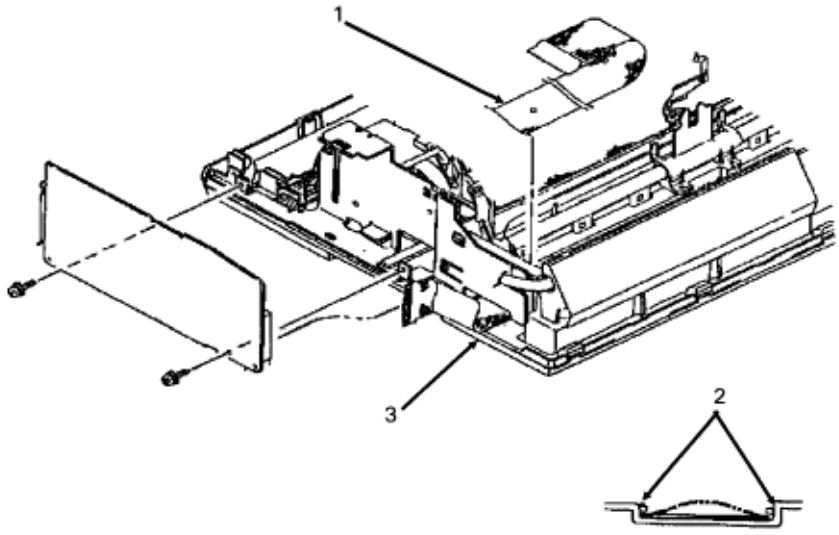
3.2.12 Carriage Cable

1. Perform these procedures:

   3.2.01
   3.2.06
   3.2.07
   3.2.11

2. Slightly bow the carriage cable (1) to release it from the claws (2) and the projection on the main frame (3).

3. Remove the carriage cable.



NOTE:

Installation
The contacts on the cable face up when the cable is positioned on the main frame.

The cable end with the 45° angled contacts connects to the gear case assembly.

DO NOT sharply bend the carriage cable. You will slightly bow the cable to position it under the claws and over the projection.

P/N 56627301 Cable: Carriage (Narrow) RSPL 590 **B.2.06**

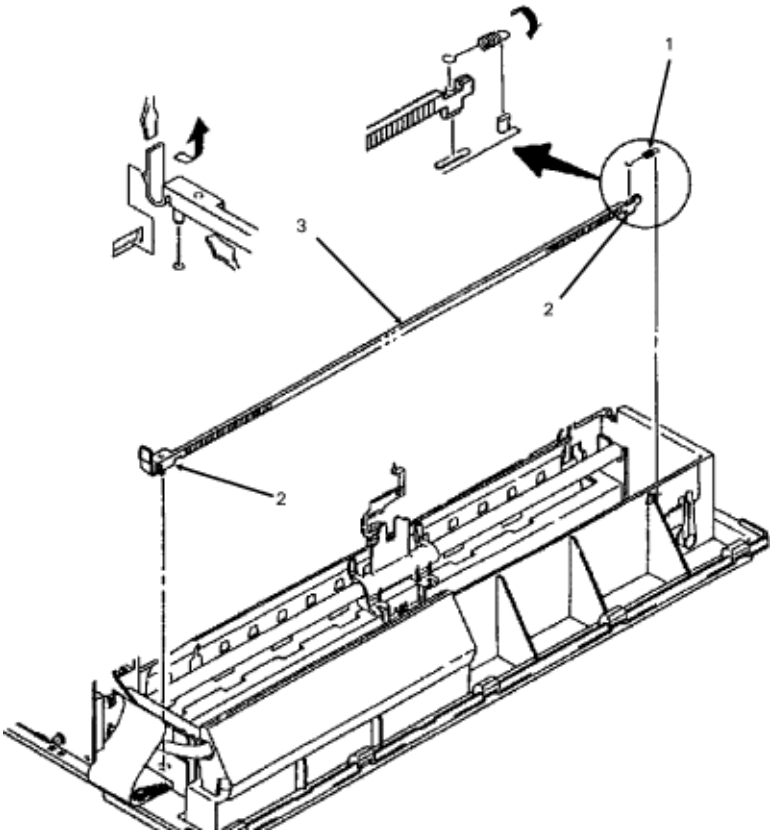
P/N 56627302 Cable: Carriage (Wide) RSPL 591 B.2.06

3.2.13 Space Rack

1. Perform these procedures:

   3.2.01
   3.2.02
   3.2.04
   3.2.10
   3.2.11

2. Remove the spring (1).
3. Disengage the claws (2) on the both ends of the space rack (3).
4. Pull the space rack straight up and remove it.



NOTE:

Installation
After installing the space rack, check the printhead gap adjustment. Refer to Section 3.3 of this Service Handbook. (

Cleaning

When cleaning, refer to Section 3.4 of this Service Handbook.

CAUTION

DO NOT lubricate the space rack. Lubricating the space rack will attract dust. If enough dust accumulates on the space rack, printing problems will occur.

P/N 50923501	Spring: Tension (Space Rack)	RSPL	Both	B.2.03
P/N 53563301	Rack: Space (Narrow)	RSPL	590	B.2.03
P/N 53563401	Rack: Space (Wide)	RSPL	591	B.2.03

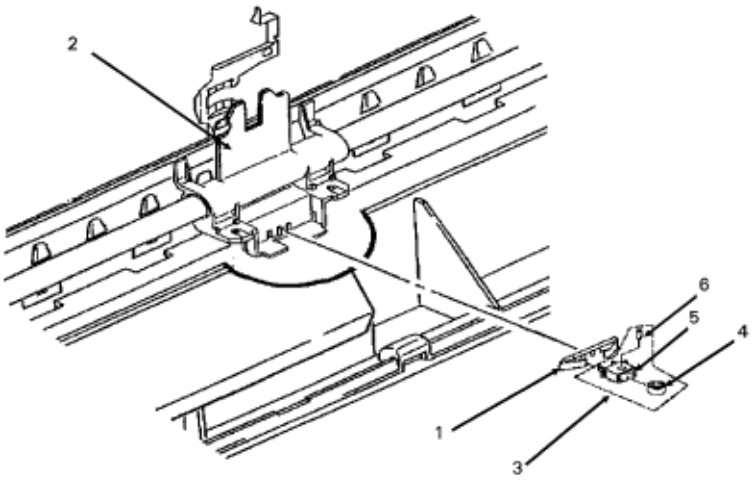
3.2.14 Roller/Holder Backup Assembly

1. Perform these procedures:

   3.2.01
   3.2.02
   3.2.04
   3.2.11

2. Use a small straight slot screwdriver to disengage the claws of the backup roller holder spring (1) from the carriage frame (2).

3. Remove the roller/holder backup assembly (3).



NOTE:

The roller/holder backup assembly includes the backup roller (4), the backup roller holder (5), and the pin (6).

P/N 53343201	Assembly: Roller/Holder Backup		Both	B.2.06
P/N 53341701	Roller: Back Up	RSPL	Both	B.2.06
P/N 53341801	Holder: Back Up Roller	RSPL	Both	B.2.06
P/N N/A`	Pin		Both	B.2.06
P/N N/A	Backup Roller Holder Spring	Both	B.2.06	

3.2.15 Guide Rail and Adjust Cam

1. Perform these procedures:

   3.2.01
   3.2.02
   3.2.04
   3.2.11
   3.2.14

2. Rotate the adjust cam (1) in the direction of arrow A as far as possible.

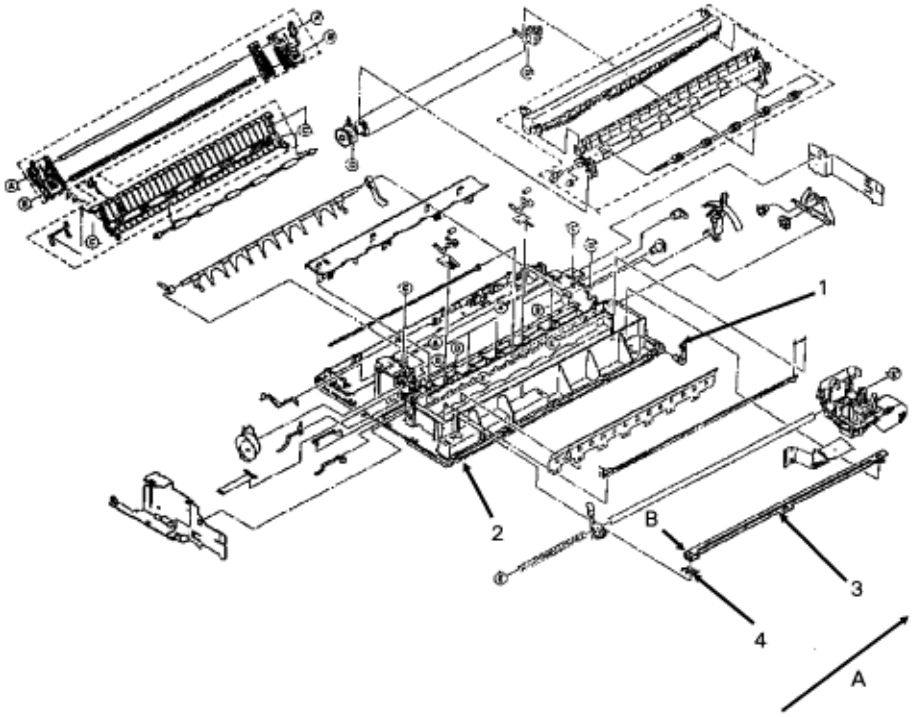
3. Pull the cam out and remove it.

4. Carefully press the claw (2 location only) in the base frame down to release the guide rail (3). Do not press too hard or the claw will break.

5. Use a straight slot screwdriver to slide the guide rail in direction of arrow A.

6. Lift the guide at position B and work the other end of the guide free to remove the guide rail.

7. Remove the ground clip (4)



NOTE:

Installation
After installing the guide rail, check the printhead gap adjustment. **Refer to Section 3.3 of this Service Handbook.**

P/N 51009701	Guide: Rail Ground Clip	RSPL	Both	**B.2.03**
P/N 51009801	Guide: Rail (Narrow)	RSPL	590	**B.2.03**
P/N 51009901	Guide: Rail (Wide)	RSPL	591	**B.2.03**
P/N 53067701	Cam: Adjust	RSPL	Both	**B.2.03**

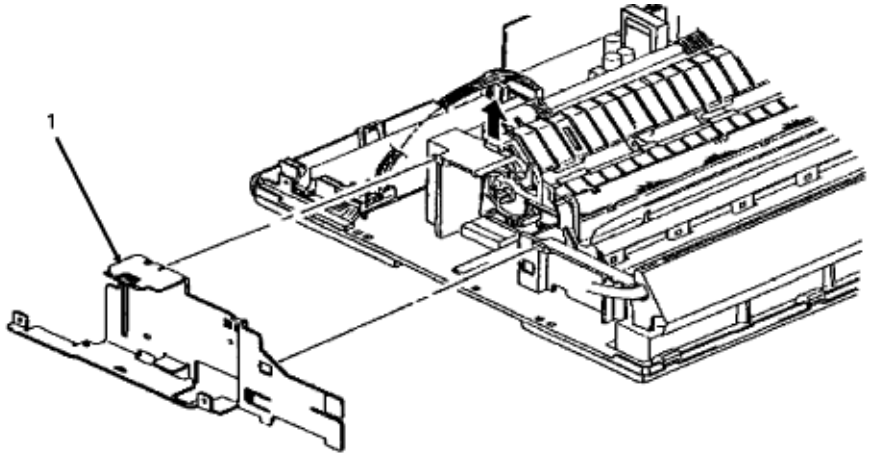
3.2.16 Left Ground Plate

1. Perform these procedures:

   3.2.01
   3.2.06
   3.2.07

2. Cut the nylon tie and release the cable. (Not shown).

3. Work the left ground plate (1) up, and then out, to remove it.



P/N 51010301 Plate: Left Ground RSPL Both B.2.03

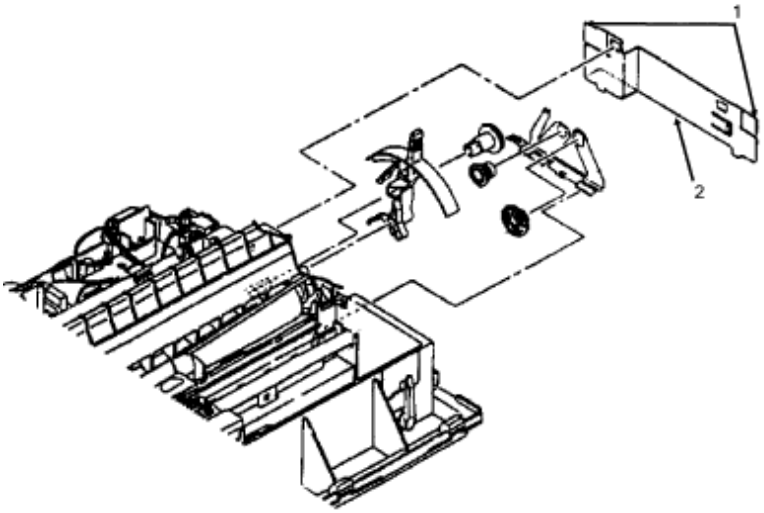
3.2.17 Right Ground Plate

1. Perform these procedures:

   3.2.01
   3.2.06

2. Pull the top tabs (1) of the right ground plate (2) out to free the plate from the claws of the base frame. You may have to use a screwdriver to work the plate tabs free.

3. Lift the plate and remove it.



NOTE:

Installation
The plate must be securely seated under the claws.

P/N 51010201 Plate: Right Ground RSPL Both **B.2.04**

3.2.18 Rear and Cut Sheet Paper Feed Sensor Levers

1. Perform these procedures:

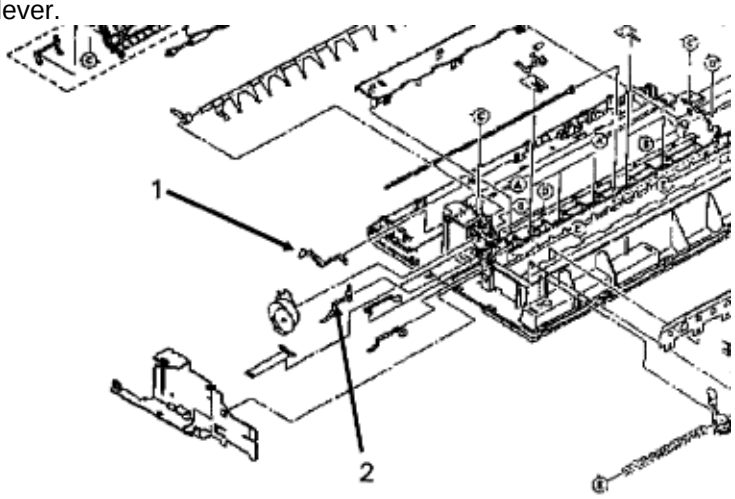
   3.2.01
   3.2.06
   3.2.07
   3.2.16

2. Turn the cut sheet/continuous feed paper sensor lever (1) until the flag is at the top, then work the lever free.

3. Remove the lever.

4. Turn the rear feed paper sensor lever (2) until the flag is at the top, then work the lever free.

5. Remove the lever.



P/N 50804902 Lever: Sensor Cut Sheet/Continuous RSPL Both **B.2.03**

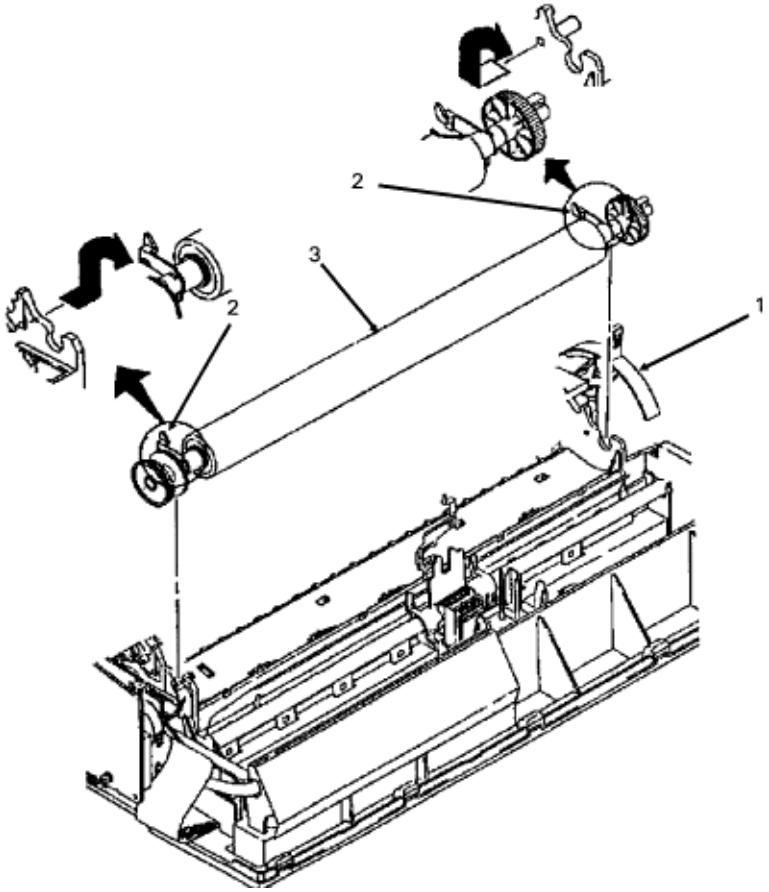
P/N 50804801 Lever: Rear Sensor RSPL Both **B.2.03**

3.2.19 Platen Assembly

1. Perform these procedures:

   3.2.01
   3.2.06

2. Move the change lever (1) to the bottom feed position (to the rear of the printer).
3. Push the lock levers (2) in, then rotate them towards the front to unlock them from the frame.
4. The levers should be vertical.
5. Lift the platen assembly (3) straight up and remove it.



NOTE:

Installation

After installing the platen assembly, check the printhead gap adjustment. **Refer to Section 3.3 of this Service Handbook.**

Cleaning

When cleaning, refer to Section 3.4 of this Service Handbook.

Lubrication

When lubricating, refer to Section 3.5 of this Service Handbook.

P/N 50098301	Platen Assembly (Narrow)	RSPL	590	**B.2.04**
P/N 50098302	Platen Assembly (Wide)	RSPL	591	**B.2.04**

3.2.20 Paper Chute Assembly

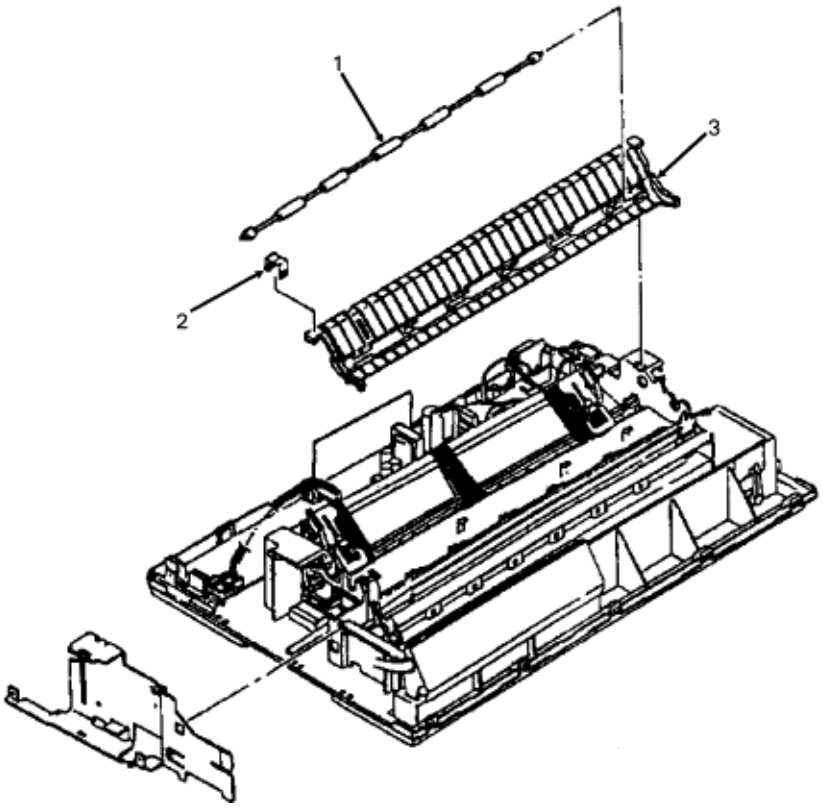
1. Perform these procedures:

   3.2.01
   3.2.06
   3.2.19

2. Remove the rear pressure roller (1).

3. Use a straight slot screwdriver to release the claws of the lock spring (2) and remove the spring.

4. Remove the paper chute assembly (3).



NOTE:
The paper chute assembly includes the levers for the rear and top paper feed paths.

P/N 53341301 Roller: Pressure Rear (Narrow) RSPL 590 B.2.05

P/N 53341401	Roller: Pressure Rear (Wide)	RSPL	591	B.2.05
P/N 50924701	Spring: Lock	RSPL	Both	B.2.05
P/N 50097701	Paper Chute Assembly N	RSPL	590	B.2.05
P/N 50097801	Paper Chute Assembly W	RSPL	591	B.2.05

3.2.21 Line Feed Motor Assembly

1. Perform these procedures:

   3.2.01

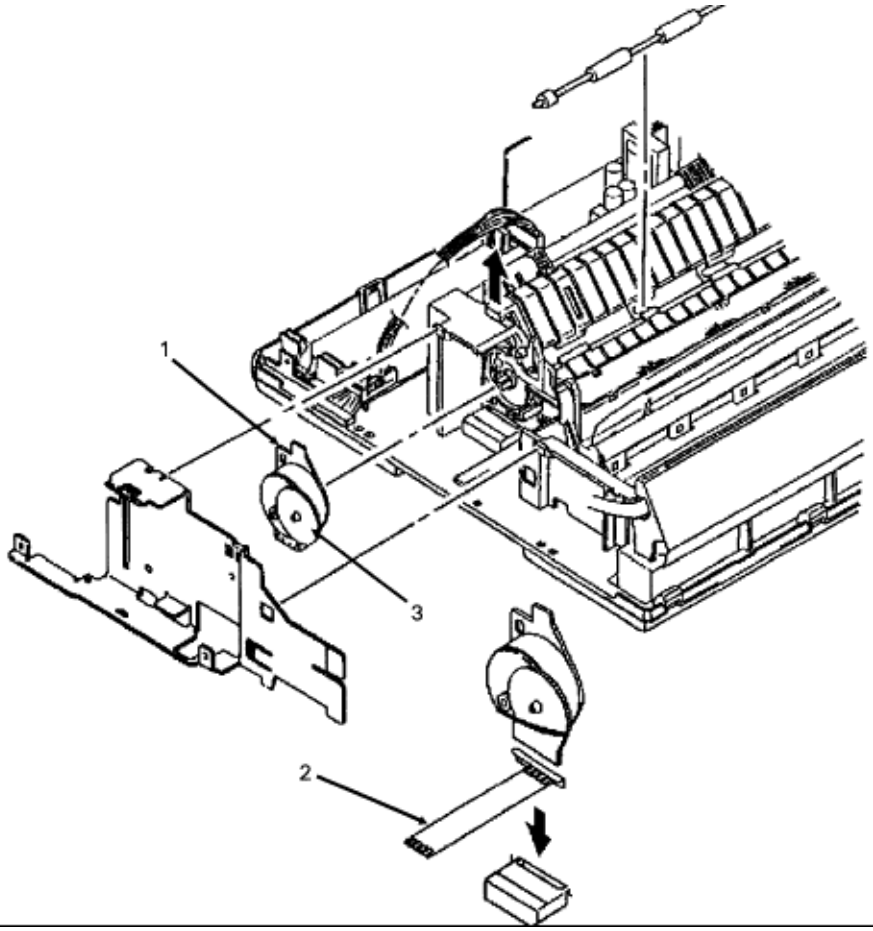
   3.2.06

   3.2.07

   3.2.16

   3.2.20

2. Firmly press down on the line feed motor assembly (1) while tilting the assembly out.
3. Remove the line feed motor assembly.
4. Remove the line feed connection cord (2).



CAUTION:
The line feed idle gear (3) should be removed only if it must be replaced. The claws will break when the gear is removed. A new gear must be installed.

P/N 51228401	Gear: Line Feed Idle	RSPL	Both	B.2.03
P/N 56510301	Motor: Line Feed (Assembly)	RSPL	Both	B.2.03
P/N 56627201	Cord: Connection Line Feed	RSPL	Both	B.2.03

3.2.22 Reset Spring

CAUTION:
Please read through this entire procedure before performing it.

Do not press against the vertical extensions of the reset spring at any time during this procedure.

Firm pressure will release the spring, not brute force.

1. Perform these procedures:

   3.2.01

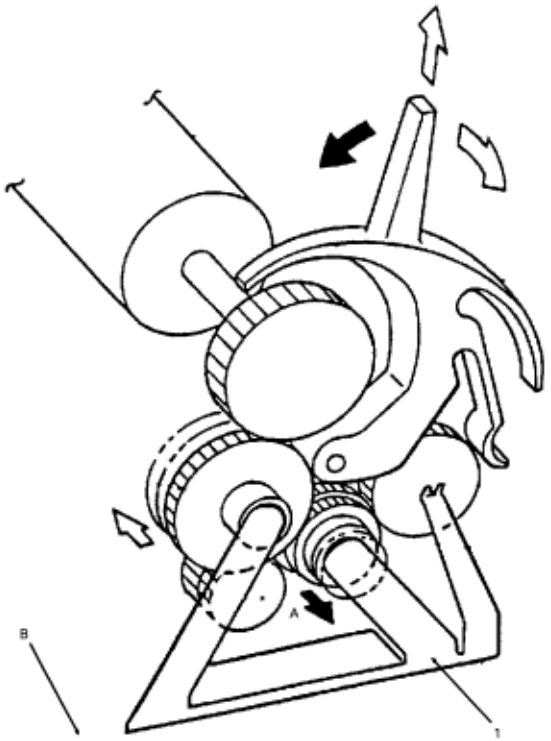
   3.2.06

   3.2.17

2. Place the right side of the unit over the edge of your work surface. You must be able to access the bottom of the unit. You will be working underneath and above the reset spring (1) at the same time.

3. Reach from underneath the unit and press up at the extension (A) to free the spring from the claw.

4. While pressing up, slide the spring out (in the direction of Arrow B) and remove it.



P/N 50923201 Spring: Reset RSPL Both B.2.04

3.2.23 Idle Gear and Change Lever

1. Perform these procedures:

   3.2.01

   3.2.06

   3.2.07

   3.2.16

   3.2.17

   3.2.19

   3.2.20

   3.2.22

2. Remove the idle gear (1). The idle gear is a large narrow gear.
3. Release the claw (2) of the change lever (3). The claw is accessed from inside the unit.
4. Remove the change lever.